March 1989

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THE COLOR COMPUTER MONTHLY MAGAZINE

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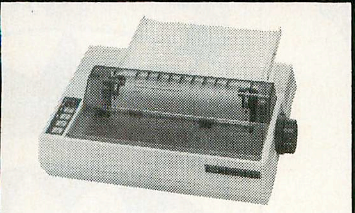
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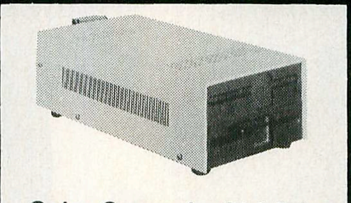
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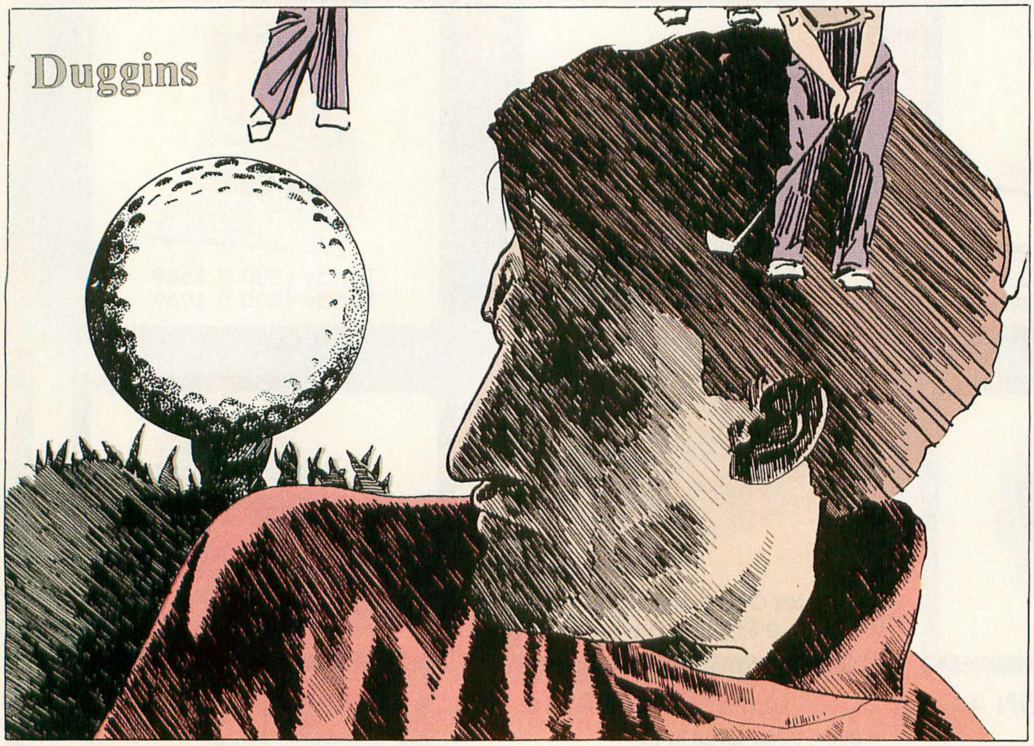

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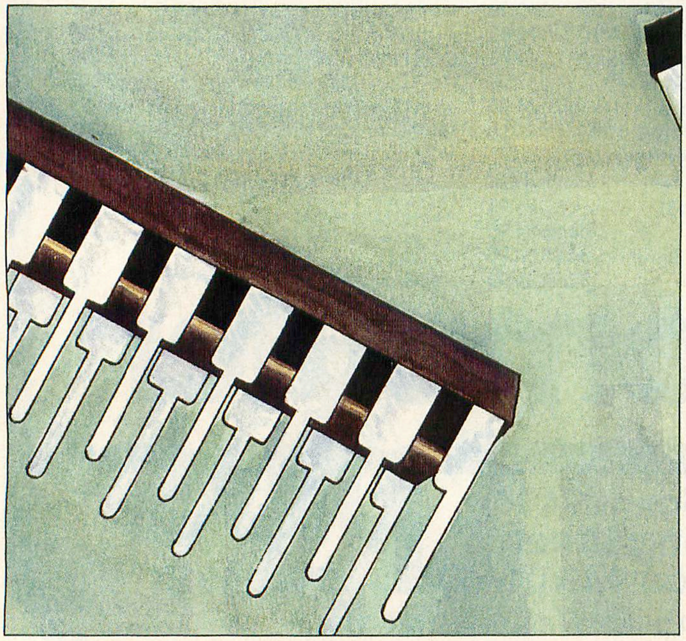

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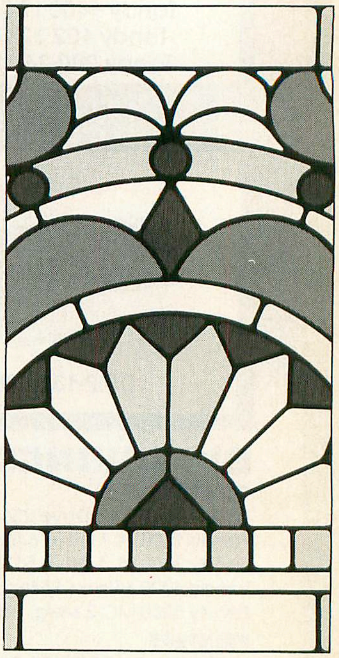

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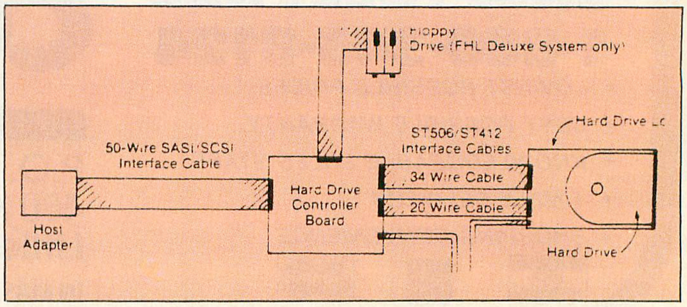
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Letters to the RAINBOW

Ma Bell "Bytes" Off a "Bit" Too Much

Editor:

On September 30, SysOps of bulletin board systems in the Houston area began receiving calls from Southwestern Bell Telephone Company stating that their rates would be changed from residential to commercial. This decision on the part of Bell was due to a "recent clarification of an existing tariff." Although those who received the calls protested that they were not in business and that their bulletin board systems were free, Bell did not relent.

The higher rates will not only mean a lower resale value on many computer owner's expensive equipment, but, for some, will put an end to a once-affordable hobby.

Southwestern Bell spokesman Ken Brasel said Bell was simply rectifying its own error. "We shouldn't have connected these (bulletin boards) at the residential rate to begin with," he said. "When the lines are used to provide a service to others, it is business. Whether for profit or not isn't germane."

By this definition, what distinction *is* there between business and residential users? Some may argue that since churches, government, charities and other nonprofit organizations are charged at business rates, the same rule applies to home computer users. But even those organizations endeavor to make money, taxable or nontaxable. Users of SysOps and BBSs, however, generally do not. In fact, the only connection with *business* these persons have is that their hobby has worked to greatly expand and develop the telecommunications industry, making equipment more affordable.

Computer users everywhere have begun a letter writing and phone call campaign to Bell, the Public Utilities Commission of Texas and the FCC. It has been sucessful in temporarily reversing the commercial rate to free BBSs. We hope the new tariff will recommend BBS users be charged at the residential rate, but we need continued support.

Beware: If it happened in Texas, it could also happen in your state.

Nancy Ward, Secretary
Houston Area CoCo Club
Pasadena, Texas

BACK TALK

Editor:

I read with interest the letter written in "utter desparation" to RAINBOW by Mr. Ron Hengerer of Jacksonville, Florida (January '88, Page 6). It seems to me that Mr. Hengerer should be doing what the fellow on the cover is doing in the same issue. I often wonder what some of those who buy computers and other electronic devices do with the manuals that come with them. It seems to me that 95 percent or more of questions asked by novices can be answered by the manual. The clincher was the fact that he bought a modem and does not know what it is or what it is used for. If a beginner starts at the front of the manual, studies each chapter in turn until he comes to the last one, and tries the do-it-yourself programs as I did a couple of years ago, he will have fewer problems. He will know about pokes and peeks, sines and cosines, for they are all in the book. This is not to say I did not have questions, but only after searching both manuals packed in the box with my Color Computer 3 did I ask them elsewhere.

Russell Robbins
Pennsauken, New Jersey

REQUEST HOTLINE

Editor:

For those of us who came back to CoCo, please be so kind as to reprint some of those old utilities. I'm referring to such programs as *Merge* for disk drives, found in "Get it Together With Disk Merge" (February '85, Page 175). Also, you had a program that runs programs from tape without pulling the disk drive interface out of the computer.

I have a CoCo 2 and a single drive from Radio Shack as well as many 1985 programs. For awhile, after suffering a stroke, my programming days were over. But now I have the ability to continue my past pleasures, and I would like to run old tapes through the disk drive, as well as the new ones found in your magazine.

I hope to find them in future issues. It feels good to get back in the world of digitals.

Norbert B. Nowak
Taylor, Michigan

Welcome back to computing!

There's no need to miss out on past issues of THE RAINBOW. See Page ??? for a list of the back issues that are available. Although some issues are no longer in print, article copies can be obtained for $2, and back issues of RAINBOW ON TAPE and DISK are always available (see page ??? for more details).

To free up more memory to run long programs without unplugging your disk drive, check out Jeremy Spiller's Disk Off *program (July '88, Page 118). While this version runs on the CoCo 1 and 2, a version for the CoCo 3 is printed on Page 100 of the December '88 issue.*

And They're Off

Editor:

I was wondering why I have never seen an advertisement for a well-written horse-race game. I know that more people than just my family and I would like to see one.

A program like this would go over big because more than two people could play at the same time, and it could include the daily double, exacta, trifecta and quinella. Players could consider the track condition, jockey standings, speed ratings, distance of race and post position.

Anyone thinking of writing a program like the one I describe can write to me for information.

Jim Kirk
General Delivery
Logan, IL 62856

INFORMATION PLEASE

Editor:

I recently acquired two Color Computer 2s (one 16K, the other 64K). However, I was unable to buy, borrow, steal or locate a manual. Please tell me where a manual for the above can be found.

Arthur W. Woodall
605 So. Court St.
Water Valley, MS 38965

Manuals for the CoCos 1, 2 and 3 can be ordered at your local Radio Shack store through Tandy National Parts. You'll need to indicate the stock number found on the bottom of your

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KUDOS

Editor:

I am a great fan of THE RAINBOW and anxiously wait for the new one each month. I don't program at all and use the magazine for the advertisers and to keep up with the CoCo Clubs.

I am writing specifically to ask that you evaluate the word processing program *Word Power 3.2*. I have used many word processing programs, but this one is the best one I have used so far and is simple to learn.

I was able to read the instruction book in an hour and go right into using the program. For the first time I could use bold, double-wide, underline, etc. Whenever I have a problem with one of its programs (usually caused by something dumb that I have done), Microcom has always straightened me out. The owner has even called me personally when I've had a problem. If it is a bug, I get a new corrected disk within the week. Microcom has even helped me put the printer codes on the disk over the phone.

I use *Word Power* for all my word-processing needs, both personal and business. The upgrades are great but I'm surprised Microcom can keep making such a good program better.

Kenneth Brownson
Newark, Delaware

See next month's issue for a comparative review of the word processors available on the CoCo market.

A Standing Ovation

Editor:

I would like to give hearty applause to an advertiser of yours — Zebra Systems, Inc. I purchased its old *CoCo Graphics Designer*, which I was pleased with. While at the Princeton RAINBOWfest, I decided to update to *CGD Plus*. Upon returning home with my trusty program, I discovered it would not run on my CoCo 2. There were repeated conversations, notes, etc., but this company steadfastly stood by me. My problems were isolated to my system, yet Zebra promptly worked out the bugs. Now, several "test" disks later, I have a great sign, banner and card designer so simple my seven-year-old can run it by himself. Thank you, Zebra Systems!

Kathie Donaldson
Mt. Holly, New Jersey

THE RAINBOW welcomes letters to the editor. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or to conserve space.

Letters to the editor may also be sent to us through our Delphi CoCo SIG. From the CoCo SIG> prompt, type `RAI` to take you into the Rainbow Magazine Services area of the SIG. At the RAINBOW> prompt, type `LET` to reach the LETTERS> prompt and then select Letters for Publication. Be sure to include your complete name and address.

How To Read Rainbow

When we use the term CoCo, we refer to an affectionate name that was first given to the Tandy Color Computer by its many fans, users and owners.

The BASIC program listings printed in THE RAINBOW are formatted for a 32-character screen — so they show up just as they do on your CoCo screen. One easy way to check on the accuracy of your typing is to compare what character "goes under" what. If the characters match — and your line endings come out the same — you have a pretty good way of knowing that your typing is accurate.

We also have "key boxes" to show you the *minimum* system a program needs. But, *do* read the text before you start typing.

Finally, the little disk and/or cassette symbols on the table of contents and at the beginning of articles indicate that the program is available through our RAINBOW ON DISK or RAINBOW ON TAPE service.

Using Machine Language

The easiest way to "put" a machine language program into memory is to use an editor/assembler, a program you can purchase from a number of sources. All you have to do, essentially, is copy the relevant instructions from THE RAINBOW's listing into CoCo.

Another method of putting an ML listing into CoCo is called "hand assembly" — assembly by hand, which *sometimes* causes problems with `ORIGIN` or `EQUATE` statements. You ought to know something about assembly to try this.

Use the following program if you want to hand-assemble ML listings:

```
10 CLEAR200,&H3F00:I=&H3F80
20 PRINT "ADDRESS:";HEX$(I);
30 INPUT "BYTE";B$
40 POKE I, VAL("&H"+B$)
50 I=I+1:GOTO 20
```

This program assumes you have a 16K CoCo. If you have 32K, change the `&H3F00` in Line 10 to `&H7F00` and change the value of `I` to `&H7F80`.

OS-9 and RAINBOW ON DISK

The OS-9 side of RAINBOW ON DISK contains two directories: `CMDS` and `SOURCE`. It also contains a file, `read.me.first`, which explains the division of the two directories. The `CMDS` directory contains executable programs and the `SOURCE` directory contains the ASCII source code for these programs. BASIC09 *programs* will only be offered in source form so they will only be found in the `SOURCE` directory.

OS-9 is a very powerful operating system. Because of this, it is not easy to learn at first. However, while we can give specific instructions for using the OS-9 programs, you will find that the OS-9 programs will be of little use unless you are familiar with the operating system. For this reason, if you haven't "learned" OS-9 or are not comfortable with it, we suggest you read *The Complete Rainbow Guide to OS-9* by Dale Puckett and Peter Dibble.

The following is not intended as a course in OS-9. It merely states how to get the OS-9 programs from RAINBOW ON DISK to your OS-9 system disk. Use the procedures appropriate for your system. Before doing so, however, boot the OS-9 operating system according to the documentation from Radio Shack.

1) Type `load dir list copy` and press ENTER.
2) If you have only one disk drive, remove the OS-9 system disk from Drive 0 and replace it with the OS-9 side of RAINBOW ON DISK. Then type `chd/d0` and press ENTER. If you have two disk drives, leave the sytem master in Drive 0 and put the RAINBOW ON DISK in Drive 1. Then type `chd/d1` and press ENTER.
3) List the `read.me.first` file to the screen by typing `list read.me.first` and pressing ENTER.
4) Entering `dir` will give you a directory of the OS-9 side of RAINBOW ON DISK. To see what programs are in the `CMDS` directory, enter `dir cmds`. Follow a similar method to see what source files are in the `SOURCE` directory.
5) When you find a program you want to use, copy it to the `CMDS` directory on your system disk with one of the following commands:

One-drive system: `copy /d0/cmds/`*filename* `/d0/cmds/`*filename* `-s`

The system will prompt you to alternately place the source disk (RAINBOW ON DISK) or the destination disk (system disk) in Drive 0.

Two-drive system: `copy /d1/cmds/`*filename* `/d0/cmds/` *filename*

Once you have copied the program, you execute it from your system master by placing that disk in Drive 0 and entering the name of the file.

The Rainbow Seal

RAINBOW
CERTIFICATION
SEAL

The Rainbow Certification Seal is our way of helping you, the consumer. The purpose of the Seal is to certify to you that any product that carries the Seal has actually been seen by us, that it does, indeed, exist and that we have a sample copy here at THE RAINBOW.

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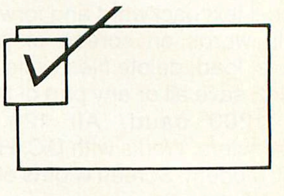
The Seal is not a "guarantee of satisfaction." The certification process is different from the review process. You are encouraged to read our reviews to determine whether the product is right for your needs.

There is absolutely no relationship between advertising in THE RAINBOW and the certification process. Certification is open and available to any product pertaining to CoCo. A Seal will be awarded to *any* commercial product, regardless of whether the firm advertises or not.

We will appreciate knowing of instances of violation of Seal use.

Rainbow Check Plus



The small box accompanying a program listing in THE RAINBOW is a "check sum" system, which is designed to help you type in programs accurately.

Rainbow Check PLUS counts the number and values of characters you type in. You can then compare the number you get to those printed in THE RAINBOW. On longer programs, some benchmark lines are given. When you reach the end of one of those lines with your typing, simply check to see if the numbers match.

To use *Rainbow Check PLUS*, type in the program and save it for later use, then type in the command `RUN` and press ENTER. Once the program has run, type `NEW` and press ENTER to remove it from the area where the program you're typing in will go.

Now, while keying in a listing from THE RAINBOW, whenever you press the down arrow key, your CoCo gives the check sum based on the length and content of the program in memory. This is to check against the numbers printed in THE RAINBOW. If your number is different, check the listing carefully to be sure you typed in the correct BASIC program code. For more details on this helpful utility, refer to H. Allen Curtis' article on Page 21 of the February 1984 RAINBOW.

Since *Rainbow Check PLUS* counts spaces and punctuation, be sure to type in the listing exactly the way it's given in the magazine.

```
10 CLS:X=256*PEEK(35)+178
20 CLEAR 25,X-1
30 X=256*PEEK (35)+178
40 FOR Z=X TO X+77
50 READ Y:W=W+Y:PRINT Z,Y;W
60 POKE Z,Y:NEXT
70 IFW=7985THEN80ELSEPRINT
   "DATA ERROR":STOP
80 EXEC X:END
90 DATA 182, 1, 106, 167, 140, 60, 134
100 DATA 126, 183, 1, 106, 190, 1, 107
110 DATA 175, 140, 50, 48, 140, 4, 191
120 DATA 1, 107, 57, 129, 10, 38, 38
130 DATA 52, 22, 79, 158, 25, 230, 129
140 DATA 39, 12, 171, 128, 171, 128
150 DATA 230, 132, 38, 250, 48, 1, 32
160 DATA 240, 183, 2, 222, 48, 140, 14
170 DATA 159, 166, 166, 132, 28, 254
180 DATA 189, 173, 198, 53, 22, 126, 0
190 DATA 0, 135, 255, 134, 40, 55
200 DATA 51, 52, 41, 0
```

Word Power 3.2

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Word Power 3.2 gives you **over 72K** on 128K and **over 450K** on 512K CoCo 3 for Text Storage - more memory than any other CoCo word-processor. Period.

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Word Power 3.2 has one of the **most powerful and user-friendly full-screen editor with word-wrap.** All you do is type. Word Power takes care of the text arrangement. The unique **Auto-Save** feature saves text to disk at regular intervals for peace of mind.

Insert/Overstrike Mode (Cursor Style Changes to indicate mode);OOPS Recall during delete;Type-ahead Buffer for fast typers;Key-Repeat (adjustable); Key-Click; 4-way cursor and scrolling; Cursor to beginning/end of text, beginning/end of line, top/bottom of screen, next/previous word; Page up/down; Delete character, previous/next word, to beginning/end of line, complete line, text before/after cursor; Locate/Replace with Wild-Card Search with auto/manual replace; Block Mark, Unmark, Copy, Move & Delete; Line Positioning (Center/Right Justified); Set/Reset 120 programmable tab stops; Word-Count; Define Top/Bottom/Left/Right margins & page length. You can also highlight text (underline-with on-screen underlining, bold, italics, superscripts, etc.). Word Power even has a **HELP** screen which an be accessed any time during edit.

SPLIT-SCREEN EDITING

Splits the screen in half so you can view one portion of your text while you edit another. You'll love it!

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Ever try mailing out the same letter to 50 different people? Could be quite a chore. Not with Word Power 3.2! Using this feature, you can type a letter, follow it with a list of addresses and have Word Power print out personalized letters. It's that easy!

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Word Power 3.2 creates ASCII format files which are compatible with almost all terminal/spell-checking & other word-processing programs. Allows you to Display Free Space, Load, Save, Append & Kill files. The ARE YOU SURE? prompt prevents accidental overwriting & deletion. You can select files by simply cursoring through the disk directory. Supports double-sided drives & step-rates.

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PUNCTUATION CHECKER

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What's Good for General Bullmoose . . .

A whole lot of you will remember "Li'l Abner," the cartoon strip by Al Capp before he retired and ended his commentary on the world scene. One of my favorite characters in "Li'l Abner" was General Bullmoose, who — in Capp's world anyway — was a very big businessman and went by the slogan, "What's good for General Bullmoose is good for everybody!"

While Capp did not always depict General Bullmoose fondly, I always liked him. He was the sort of self-starting entrepreneur who appealed to the times in which he was created. Those times, frankly, were when big business was pretty big, and in many ways General Bullmoose was right: If the economy was good and General Bullmoose was making money, then there was full employment, wages were higher and people could easily afford "a chicken in every pot and a car in every garage." (This, at least, tells you how long ago General Bullmoose was around.)

I was thinking about General Bullmoose the other day when Tandy and Panasonic announced that Tandy will be making personal computers marketed in the United States under the Panasonic label. That, as it happened, followed on the heels of a similar announcement concerning DEC (which, of interest, had a PC called *Rainbow* several years ago). Someone asked me what all this meant, and it just sort of snapped into my head: "What's good for General Bullmoose is good for everybody!" While we should not be quite so flip about the very genuine accomplishments of John Roach and his staff at Tandy in these last few years, this is true. Sure, the folks are making money, but things are going very well for a lot of people because of it.

Since I have already mixed metaphors (or whatever) here, let me add another. We need to stir in this witch's brew a heavy dose of *DeskMate* as well. *DeskMate*, as you know, has recently been "opened up" for interfaces with outside programs. That means a lot of applications will run on it in the future — and there will be a lot of sales in places all over, too. So, I think we agree that things are good for General Bullmoose. But how are they also "good for everybody?"

Quite simply, I think, it means that

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UPS 2ND DAY AIR

— more and more — the people at Tandy will have the necessary funds to continue to innovate and produce newer and better products for us. Not only will they have those funds, but they will also be able to continue to attract and hold on to the kind of people needed not only to develop those products, but to make them work.

Finally, we are talking about what is potentially a huge user base out here. Well, it is huge already. Recent statistics from an independent firm say that the percentage of persons who use personal computers is larger for Tandy computers than for any other kind. Add Panasonic selling American-made computers in every hoot and holler in the United States, and throw in DEC's marketing muscle. It leaves us with all the financial and marketing muscle (already most considerable) on the leading edge of the technology. As a good example of this, remember Tandy has developed the THOR laser disc with its read/write technology. Don't you just wonder what else is going on in those Tandy labs?

Well, I am sure you are asking just what all this stuff means as far as we CoCo owners are concerned. The truth is that it means a great deal. It means Tandy is able to market a wide range and type of computers simply because of the base it has in the market.

> ***"Tandy will be making personal computers marketed in the United States under the Panasonic label."***

Yes, I know Tandy in Canada is no longer selling the Color Computer. There are some things to remember about that, though. First, Tandy does not sell in Canada any more at all. A company called Intertan was formed about a year ago to handle Tandy's international operations. Tandy has not stopped selling — or manufacturing — Color Computers.

The reason for the decision in Canada has as much to do with the value of the dollar and international trade as anything. Canadians could always buy CoCos for less in the United States because of the relative value of the American dollar. I am betting they will keep on doing so.

Also, frankly, I think Intertan has misjudged the impact of the CoCo on the market. Certainly, everyone has misjudged the impact of the entertainment market during the past holidays — "game machines" were almost impossible to find. And, of course, for our many Canadian friends, Intertan is committed to support the CoCos it has sold over the years. That is a basic Tandy philosophy that did not change with the changes made in corporate structure.

No, I won't even mention what increased sales for Tandy means to the city of Fort Worth and environs. Many of you have heard the old joke anyway: "Welcome to Ft. Worth, a division of Tandy Corporation."

— Lonnie Falk

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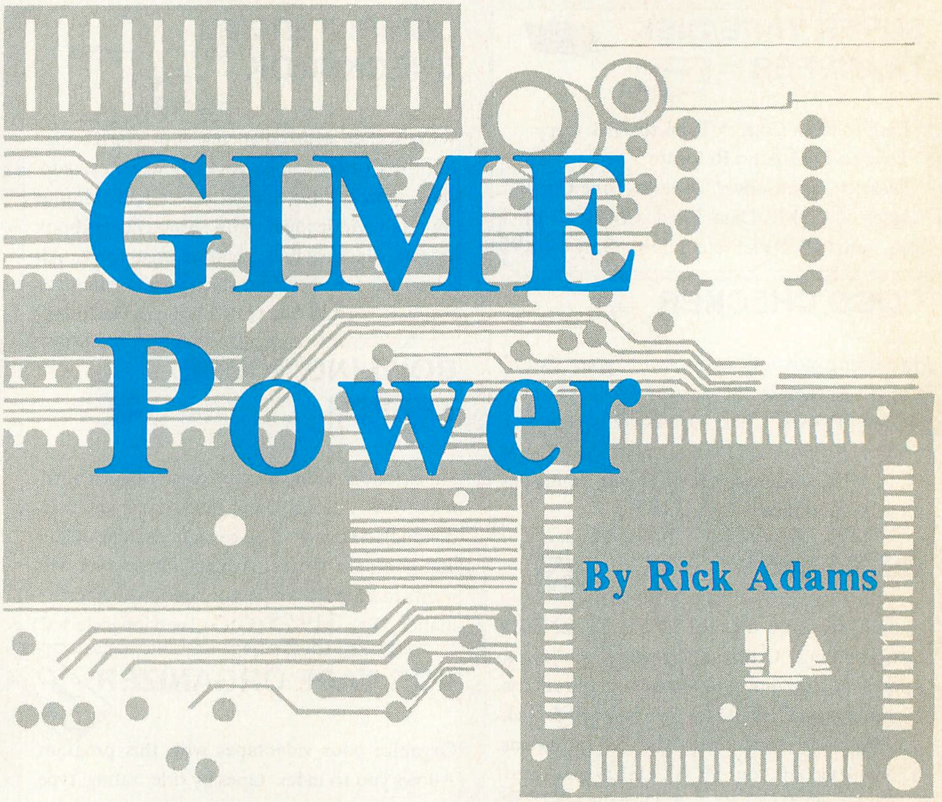

GIME Power

The powerhouse chip inside our favorite machine

By Rick Adams

Those familiar with assembly-language programming on the Color Computer 1 (and later, the Color Computer 2) became accustomed to accessing the CoCo's inner power via two Motorola chips — the SAM (Synchronous-Address Multiplexer) and VDG (Video-Display Generator). However, with the advent of the Color Computer 3 came a new programming challenge — accessing the power of the GIME chip.

The GIME (Graphics-Interrupt Memory Enhancement) is a new proprietary chip designed to Tandy's specifications. It combines the functions of the SAM and VDG chips with an array of new and more powerful functions that had been reserved for more expensive machines. Combined with the impressive power of the Motorola 6809 CPU (Central Processing Unit), the GIME makes the Color Computer 3 a powerful machine in the computer market. Add OS-9 Level II (which takes full advantage of the 6809's multitasking capabilities and the GIME's graphics power), and the combination is amazing.

Let's look at the inner workings of the GIME chip. (See Table 1 for a summary of the GIME chip's functions.) Full programming details, available in Tandy's *CoCo 3 Technical Manual*, are beyond the scope of this article, but we get an idea of how the chip works.

Communications to and from the GIME chip take place via accesses to memory between addresses $FF90 and $FFDF. Accesses to those addresses do not go to memory but are routed directly to the GIME chip hardware. Locations $FF90 and $FF91 are two initialization registers. Bits within these two bytes are used to set up the mode in which the GIME will operate. The CoCo 2-compatible bit will disable most of the GIME chip's special features, so CoCo 1 and 2 software can operate without any conflicts with the new features available. The GIME chip provides a special SAM emulation at locations $FFC0 to $FFDF to duplicate all functions of the SAM chip used by Color Computer 1 and 2 software. Thus all accesses to the SAM result in the same operations on the Color Computer 3 that would take place on a Color Computer 1 or 2, (assuming the CoCo 2-compatible bit is on).

Other bits are used to enable or disable interrupts, set up the mode of ROM mapping, and select the set of registers used for the MMU (Memory Management Unit) feature of the GIME. Interrupts are signals that cause the CPU to drop what it's doing and execute another, more important task. When that task is done, the CPU returns to what it was doing before. Addresses $FF92 and $FF93 hold two registers that offer further control over interrupts. While on the CoCo 1s and 2s certain events within the computer generate a hardware interrupt, the GIME interrupt-enable registers at $FF92 and $FF93 let you enable interrupts from events that did not generate interrupts previously. The serial port and keyboard, the display's vertical and horizontal border, the programmable timer in the GIME, and the cartridge can all generate interrupts.

$FF94 and $FF95 hold the programmable-interrupt timer within the GIME chip. This feature allows the programmer to generate interrupt signals over a wide range of time intervals. This feature is usually used to "wake up" a background task at regular intervals. This task might keep up printer I/O, handle graphics on the screen, generate sound effects or perform some other job that's inconvenient for the main task to complete. This capability is available on the Color Computer 1 and 2, but in a limited fashion. On those machines, there are only two set speeds a programmer can use for timer interrupts. One of them is too fast for any practical use, and the other is too slow for many purposes. The flexibility provided by a timer interrupt with a programmable interval is a welcome addition to the programmer's arsenal.

Two registers controlling graphics are found at locations $FF98 and $FF99. The bit-plane graphics bit turns on the GIME's Hi-Res graphics modes. If this bit is off, one of the text modes is used. If bit-plane graphics is enabled, the area of memory reserved for the video display will be interpreted as pixel data for the screen. In a four-color mode, for example, each byte of video data will be

Rick Adams (RICKADAMS) is the author of Tandy's Temple of Rom, *the CoCo 3 version of Activision's* Shanghai, *and* DelphiTerm. *Rick, his wife Alice and their three children live in Rohnert Park, California.*

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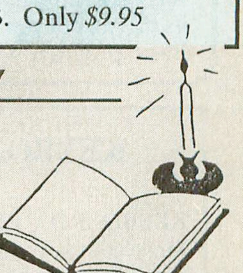

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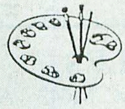

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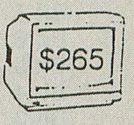

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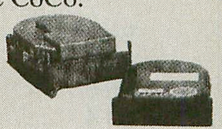

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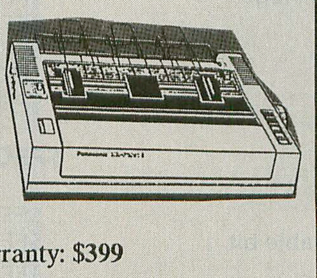

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$FF90 Initialization Register 0

Bit 7	CoCo 1 and 2-compatible bit
Bit 6	MMU enable bit
Bit 5	Enable IRQ bit
Bit 4	Enable FIRQ bit
Bit 3	Enable secondary vectors bit
Bit 2	Standard SCS bit
Bits 1 to 0	ROM map mode

$FF91 Initialization Register 1

Bit 7	
Bit 6	Memory type
Bit 5	
Bit 4	
Bit 3	
Bit 2	
Bit 1	Timer clock-select bit
Bit 0	MMU Task bit

$FF92 IRQ Enable Register

Bit 7	
Bit 6	
Bit 5	Enable IRQ from timer
Bit 4	Enable IRQ from horizontal border
Bit 3	Enable IRQ from vertical border
Bit 2	Enable IRQ from serial data input
Bit 1	Enable IRQ from keyboard
Bit 0	Enable IRQ from cartridge

$FF93 FIRQ Enable Register

Bit 7	
Bit 6	
Bit 5	Enable FIRQ from timer
Bit 4	Enable FIRQ from horizontal border
Bit 3	Enable FIRQ from vertical border
Bit 2	Enable FIRQ from serial data input
Bit 1	Enable FIRQ from keyboard
Bit 0	Enable FIRQ from cartridge

$FF94 Timer MSB
$FF95 Timer LSB
$FF96 <Reserved>
$FF97 <Reserved>

$FF98 Video Mode Register

Bit 7	Bit-plane graphics enable bit
Bit 6	
Bit 5	Artifact color mode bit
Bit 4	Composite-monochrome bit
Bit 3	50Hz bit
Bits 2 to 0	Lines per character row

$FF99 Video-Resolution Register

Bit 7	
Bits 6 to 5	Lines per field
Bits 4 to 2	Horizontal resolution
Bits 1 to 0	Color resolution

$FF9A Border-Palette Register
$FF9B <Reserved>
$FF9C Vertical-Fine Scroll Register
$FF9D Screen Start Address 1
$FF9E Screen Start Address 2
$FF9F Horizontal Offset Register

$FFA0-$FFA7 MMU Segments Task 0:

$FFA0 Logical Addresses $0000 to $1FFF
$FFA1 Logical Addresses $2000 to $3FFF
$FFA2 Logical Addresses $4000 to $5FFF
$FFA3 Logical Addresses $6000 to $7FFF
$FFA4 Logical Addresses $8000 to $9FFF
$FFA5 Logical Addresses $A000 to $BFFF
$FFA6 Logical Addresses $C000 to $DFFF
$FFA7 Logical Addresses $E000 to $FDFF

$FFA8-$FFAF MMU Segments Task 1

$FFA8 Logical Addresses $0000 to $1FFF
$FFA9 Logical Addresses $2000 to $3FFF
$FFAA Logical Addresses $4000 to $5FFF
$FFAB Logical Addresses $6000 to $7FFF
$FFAC Logical Addresses $8000 to $9FFF
$FFAD Logical Addresses $A000 to $BFFF
$FFAE Logical Addresses $C000 to $DFFF
$FFAF Logical Addresses $E000 to $FDFF

$FFB0-$FFBF Palette Registers

$FFB0 Color Palette 0 (Text Background Color 0)
$FFB1 Color Palette 1 (Text Background Color 1)
$FFB2 Color Palette 2 (Text Background Color 2)
$FFB3 Color Palette 3 (Text Background Color 3)
$FFB4 Color Palette 4 (Text Background Color 4)
$FFB5 Color Palette 5 (Text Background Color 5)
$FFB6 Color Palette 6 (Text Background Color 6)
$FFB7 Color Palette 7 (Text Background Color 7)
$FFB8 Color Palette 8 (Text Foreground Color 0)
$FFB9 Color Palette 9 (Text Foreground Color 1)
$FFBA Color Palette 10 (Text Foreground Color 2)
$FFBB Color Palette 11 (Text Foreground Color 3)
$FFBC Color Palette 12 (Text Foreground Color 4)
$FFBD Color Palette 13 (Text Foreground Color 5)
$FFBE Color Palette 14 (Text Foreground Color 6)
$FFBF Color Palette 15 (Text Foreground Color 7)

$FFC0-$FFDF SAM Emulation

$FFC0-$FFC5 Display mode control
$FFC6-$FFD3 Display offset
$FFD4-$FFD5 Base page
$FFD6-$FFD7 <Unused>
$FFD8-$FFD9 CPU rate
$FFDA-$FFDD <Unused>
$FFDE-$FFDF Map type

Table 1: GIME Chip Functions

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The Works includes everything below

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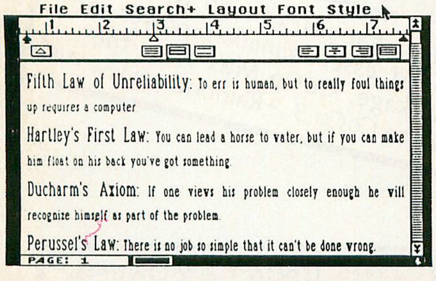
Save $80.00

Max-10+

Now with online 40,000 word spellchecker

Regularly $79.95

The latest in CoCo word processors and the only one with true WYSIWYG (What You See Is What You Get) output. Mix graphics with text. Max-10 is great for anything from greeting cards up to newsletters. Just turn the next page for a full list of Max-10's unbelievable features.



Fifth Law of Unreliability: To err is human, but to really foul things up requires a computer

Hartley's First Law: You can lead a horse to water, but if you can make him float on his back you've got something.

Ducharm's Axiom: If one views his problem closely enough he will recognize himself as part of the problem.

Perussel's Law: There is no job so simple that it can't be done wrong.

Max-10 Font Set

Regularly $29.95

36 fonts on 2 disks. Can all be used easily and quickly with Max-10.

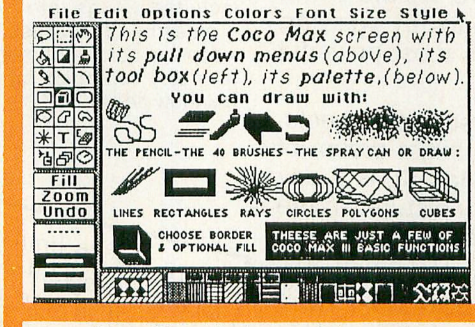
Frontier 18 point
Athens 18 point
Irvine 12 point
Irvine 24
Swan Song 12 point
Swan Song 24
Ellesmere 12 point
Ellesmere 24 point
Ellesmere Bold 24
Digital 12 point
Longhand 24
Hollow 12 point
Hollow 18 point
Rome 9 point
Rome 12 point
Stencil 18 point
Futura 24
Courier 12 point
Brookhaven 18
Thames 18 point
San Francisco 18
Century 24

All these and 14 more!

CoCo Max III

Regularly $79.95

The ultimate graphics creation program. See the list of features on the next page. Also read the superb review in **The Rainbow**, *April 1988*.



This is the Coco Max screen with its pull down menus (above), its tool box (left), its palette, (below).

You can draw with:

THE PENCIL - THE 40 BRUSHES - THE SPRAY CAN OR DRAW:

LINES RECTANGLES RAYS CIRCLES POLYGONS CUBES

CHOOSE BORDER & OPTIONAL FILL

THEESE ARE JUST A FEW OF COCO MAX III BASIC FUNCTIONS

CoCo Max Fonts

Regularly $49.95

Almost 100 fonts for incredible headlines and text. Four disks full of fonts. Use CoCo Max styles (Bold, Italic, 3-D, Shadow ...), sizing and colors for absolutely wonderful effects. Thousands of combinations are possible. Here are some of the fonts:

BLOCK UP
Harlow
Koloss
maharajah
[illegible]
Peignot Small
Peignot Large
PROGRAM SMALL
PROGRAM MEDIUM
PROGRAM LARGE
ROCK&ROLL
Futura Black Small
FUTURA BLK. LG
HANG UP
[illegible]
LIQUID CRYSTAL
Мосцоя Смолл
Мосцоя Ларге
ORBIT
POINT OUT
Printout Small
PRINTOUT LARGE
Digital Small
Digital Medium
Digital Large
Futura
Grid Small
GRID LARGE
HAIFA
[illegible]
[illegible]
TABLEAU
Victory
Baby Teeth Small
BABY TEETH LG.
BOBO BOLD
BOOKS
Cartwheel
Fine Print
Normande Small
Normande Medium
NORMANDE LG.
Plano
SINALOA
[illegible]

30 DAY TRIAL OFFER AND OUR NO-RISK GUARANTEE

We understand perfectly that you have no reason to believe anything you read. Including this ad. (Or the rave reviews)

So we invite you to evaluate **The Works** yourself. Call and order it. We'll send it with detailed, clear instructions. Use it with your own CoCo 3, on your own work, for 30 days. Try it for brilliant presentation graphics, outstanding word processing. Wring it out.

After 30 days, if it isn't for you, for any reason, we'll take it back and write you a check immediately for your full purchase price.

The risk is all ours. But we urge you not to wait, this deal may end soon. We can guarantee this price only if you order now.

Call today. You have nothing to lose.

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Order line open weekdays 9 to 5 Eastern time
See next page for more ordering info.

COLORWARE
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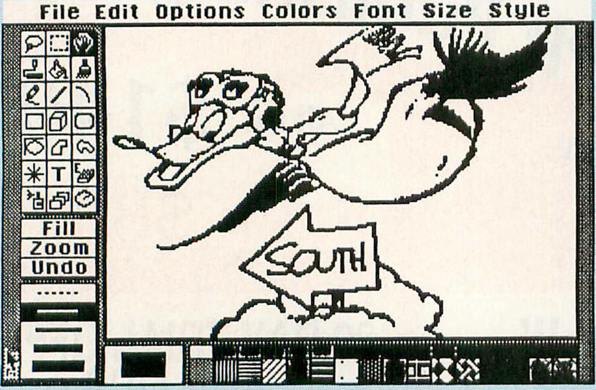
NEW

REAL DESKTOP

CoCo Max™ III AND



CoCo Max III is absolutely the best drawing package available for the CoCo 3, and it does more than just let you draw. **CoCo Max III** includes animation, text, color mixing and more features than you would think possible. It combines incredible speed with dazzling graphics and it is a joy to use even its most powerful features.

Pictures, graphs, flyers, cards, signs, school projects, labels, buttons and anything else you might dream of creating is now possible with **CoCo Max III**. Is it any wonder that the majority of CoCo Gallery pictures in the last five months were created with **CoCo Max?**

Thousands of CoCo users have found that you don't have to be an artist to have fun with **CoCo Max**. You'll wonder why you waited so long to get the incredible **CoCo Max III**.

CoCo Max III is the best because it includes:
– a huge picture area (*two* full hi-res 320x192 screens) – a large editing window – Zoom mode for detail work – 28 drawing tools which you just point and click on – shrink and stretch – rotation at any angle (1.5 degree steps) – 512K memory support (*all* features work with 128K too) – an Undo feature to correct mistakes – you can even Undo an "Undo" – Animation – special effects – color sequencing (8 colors, variable speed) – thirteen fonts (more available) – each font has eight different sizes – five style options (bold, italic, 3D, etc.) for thousands of font/size/style combination possibilities. – the CoCo Show "slide show" program – color editing of patterns – automatic pattern alignment – prints in single and double size – smart lasso (move text over a background...) – advanced tools: arc, ray, cube, etc. – select 16 of the 64 colors (all 64 colors are displayed at once for selection!) – picture converter (CoCo Max II, MGE, BASIC) – extensive prompting – "glyphic" clipbook of rubber stamps – double click shortcuts – color mixing (additive/subtractive/none) – money back guarantee – sophisticated data compression saves disk space – pull down menus (no commands to remember) – forty paintbrush shapes – two color lettering – spray can – scrapbooks of pictures – error free – Y-cable or multipack not required – high speed hi-res interface included (plugs into joystick port) – disk is not copy protected – amazing "flowbrush" – RGB and composite monitor support – replace color – printing on black and white printers in five shades of gray – full color printing with optional drivers for the NX-1000 Rainbow and CGP220 – entirely rewritten for the CoCo 3

> There are no limits to what you can do with this fabulous program. Speed, ease, animation, power and color, all in one package. **CoCo Max III** is the ultimate program for the CoCo 3. –Rainbow review 4/88

CoCo Max III: $79.95

Max-10 owners: deduct $10

System Requirements:
CoCo 3 disk system and a Joystick or Mouse

Printer drivers included:
IBM/Epson and compatibles, GEMINI, DMP105/106/130, OKI182/192, CGP220 (B&W), DMP110, DMP200

Color printer drivers (prints 125 different colors) Star NX-1000, CGP-220, or Okimate 20 each **$19.95**

For all CoCo Max Versions

Max Edit Font Editor: A font is a set of characters of a particular style. With Max Edit you can create new fonts or modify the existing ones. **$19.95**

Max Font disks (send for list) each **$19.95**

Max Font Set (95 fonts on 4 disks) **$49.95**

DS69/69B Digitizers: allows you to capture the image from a VCR or video camera and bring it into your computer. CoCo Max will let you load digitized pictures and modify them.

DS-69 (2 images per second. Requires multipak) **$99.95**

DS-69B (8 images/second) **$149.95**

CoCo 1 & 2 Owners Still Available:

(See previous ads or write for information)

CoCo Max II (works on all disk CoCos) **$69.95**

CoCo Max Tape (CoCo 1 & 2 only) **$59.95**

Y-Cable **$24.95**

CoCo Max II Picture Disk Set
set of 3 disks: **$29.95**

Guaranteed Satisfaction
Use CoCo Max or Max-10 for a full month.
If you are not delighted with either of them,
we will refund every penny.

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A division of Sigma Industries, Inc.

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(203) 656-1806 MON-FRI 9 to 5 EST
Visa or Mastercard accepted. C.O.D. orders $3 extra
Check or M.O. to: Colorware, 242-W West Ave, Darien CT 06820
Add $3 per order for shipping ($5 to Canada, 10% to overseas)
CT residents add 7.5% sales tax

PUBLISHING

COLORWARE

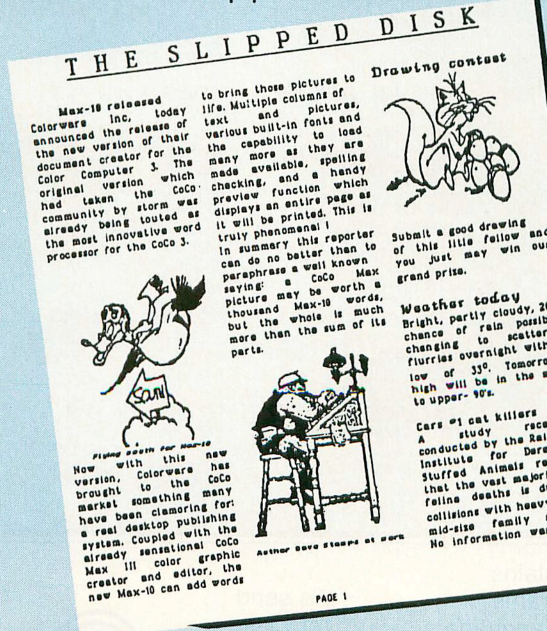
Max-10™

THE DAZZLING WORD PROCESSOR

You probably already have a word processor, and you probably wish it had these features:

- Fully menu driven (CoCo Max style) with point and click marking of text. You don't need the arrow keys!
- True WYSIWYG (What You See Is What You Get) including variable size fonts, styles (bold, italics, etc.) and graphics.
- Can print multiple columns on a page.
- Not limited by printer capabilities: fonts up to 24 points (1/3") high, superscripts, small print, etc.
- Fully integrated spelling checker (incredibly fast), no need to exit program to check spelling.
- Graphics can be imported from just about anything (CoCo Max; MGE; BASIC; even Macintosh pictures from a BBS) and resized to fit your document.
- Full screen preview including graphics.

Max-10 has all these unique features, plus all the features you are used to in your current word processor. Even with all this, you don't give up anything. **Max-10** is easier to use, more intuitive, faster and more powerful than anything else. It's not just a word processor, it's a desktop publisher.



THE SLIPPED DISK

Max-10 released
Colorware Inc, today announced the release of the new version of their document creator for the Color Computer 3. The original version which had taken the CoCo community by storm was already being touted as the most innovative word processor for the CoCo 3.

Flying south for Max-10

Now with this new version, Colorware has brought to the CoCo market something many have been clamoring for: a real desktop publishing system. Coupled with the already sensational CoCo Max III color graphic creator and editor, the new Max-10 can add words to bring those pictures to life. Multiple columns of text and pictures, various built-in fonts and the capability to load many more as they are made available, spelling checking, and a handy preview function which displays an entire page as it will be printed. This is truly phenomenal !
In summary this reporter can do no better than to paraphrase a well known saying: a CoCo Max picture may be worth a thousand Max-10 words, but the whole is much more than the sum of its parts.

Author Dave Stamps at work

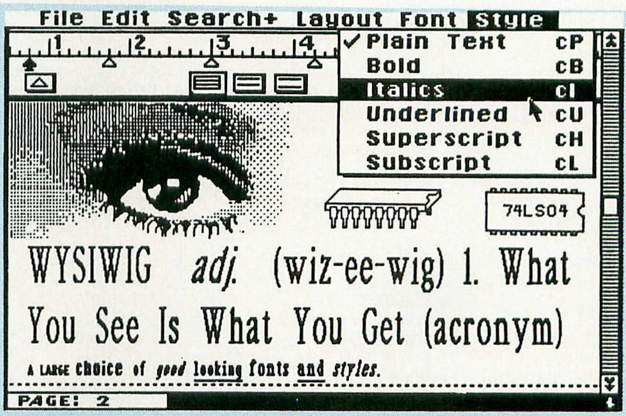
Drawing contest
Submit a good drawing of this litle fellow and you just may win our grand prize.

Weather today
Bright, partly cloudy, 20% chance of rain possibly changing to scattered flurries overnight with a low of 33°. Tomorrow's high will be in the mid- to upper- 90's.

Cars #1 cat killers
A study recently conducted by the Rainbow Institute for Deranged Stuffed Animals reveals that the vast majority of feline deaths is due to collisions with heavy mid-size family sedans. No information was made

PAGE 1

Max–10: $79.95
CoCo Max III owners: deduct $10
Max–10 requires a CoCo 3, at least 1 disk, & joystick or mouse
Printer drivers included: IBM/Epson and compatibles; DMP 105, DMP106, DMP130; CGP220 (B&W); Gemini/Star



WYSIWIG *adj.* (wiz-ee-wig) 1. What You See Is What You Get (acronym)

A LARGE choice of *good* looking fonts and *styles.*

Some of the many features of **Max–10:**
– Blinding speed – printing in multiple columns – online dictionary – spell checking – graphics can be mixed with text – full justification of proportionally sized characters – bold, italic, underline superscript and subscript type styles – superb file support, just point and click – "Undo" lets you correct mistakes – easy to use, no commands to remember – any graphics program can be used – pictures can be shrunk or stretched to fit – right and left alignment – centering – variable line spacing – page numbering – current page number displayed on the screen – variable tab stops – left and right margins – tabs and margins can vary in the same document – cut and paste text and graphics anywhere in the file – page break shows on the screen – pull down menus are quick and simple to use – lightning fast access to any point in the document with the scroll box – twenty fonts (styles and sizes), more available – any number of character sizes and styles can be mixed on the same line – up to more than 120 characters per line, depending on font size, style and letters – headers and footers, even with graphics – file compatibility with other word processors – right, left, bottom and top margins – word wrap – set starting page – type ahead – key repeat – key click – scroll up and down – ASCII file output for compatibility – disk directory – kill files- block cut, copy and move – global search and replace – paragraph indent – clipboard – merge – show file (on disk) – free memory display – page count – paragraph count – word count – graphics can be resized and moved – multiple fonts – error recovery – true lowercase – 512K memory support (all features work with 128K too) – complete point and click cursor control – moving, clearing and changing blocks of text is ridiculously easy, just point and click at each end of the text block – onscreen ruler – preview file before loading – search and replace – disk is not copy protected – more than 35 pages of text

CoCo Max III and Max–10 Perfect Together

You do not *need* **CoCo Max III** to insert and print graphics in **Max–10**. Max–10 works with any graphics creation program, and you can also use graphics downloaded from bulletin boards.

Similarly, you do not *need* **Max–10** to create graphics with text in **CoCo Max III**. There are tremendous lettering capabilities in **CoCo Max III**, with its many fonts, styles, and sizes.

Together **Max–10** and **CoCo Max III** are an unbeatable combination. This desktop publishing system is better than anything you've ever seen on a CoCo. We are so confident that you will use, and enjoy using the two software packages, that we offer an unconditional money back guarantee. Stop wasting your time and effort using inferior or obsolete products. Move up to the new generation of CoCo software now.

T & D SOFTWARE PRICE

ISSUE #1, JULY 1982
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CALENDAR
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DISK UTILITY
MACH II
ELECTRONIC BILLBOARD
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All 80 Issues	**$220.00**

Purchase 20 or more issues and receive a free 6 month subscription.

- Every Issue Contains 10 or More Programs
- Many Machine Language Programs
- Available for COCO I, II and III
- All Programs Include Documentation

- We send 1st Class No Charge
- Personal Checks Welcome!

RAINBOW
CERTIFICATION
SEAL

BLOWOUT SALE

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WATER COST
ZIGMA EXPERIMENT
MUSICAL CHORDS
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PLEASE CIRCLE

TAPE or DISK

interpreted as four 2-bit values, specifying four dots (or pixels) of video on the display. The values of each of these 2-bit values are used to reference the color palettes, which contain the color codes to be used. For a 16-color mode, each byte of video data will be interpreted as two 4-bit values. (Of course, more RAM is needed for such a screen.) For text modes, the data in the video display memory will be interpreted differently.

Each character on a text screen is specified by two adjacent bytes in memory. The first byte is the character itself, in ASCII code. The second, called the *attribute* byte, specifies the manner in which the character is displayed. It is interpreted like this:

Attribute	**Byte**
Bit 7	Blink
Bit 6	Underline
Bits 5 to 3	Foreground palette for character
Bits 2 to 0	Background palette for character

The background palette has eight added to it before it is used. Thus, a zero in bits 2 through 0 results in the use of Palette 8, a one, Palette 9, and so on.

Bit 5 of the video mode register at Location $FF98 controls the color set available to Color Computer 1 and 2 programs using artifact colors. This trick, discovered after the release of the Color Computer 1, enables color sets not supported by the original VDG chip. The only drawback is that the color set selected is dependent on the clock's state at the time the computer is turned on or reset — requiring the user to press reset repeatedly until the proper colors appear. (Any software that has a setup screen with a message like "Press Reset until this square is blue" uses this mode.)

The artifact-color mode bit removes this guesswork. Depending on the original programming, a value of either zero or one in this bit will make the software come up in the proper mode every time. This bit is set to one value or the other depending on whether the F1 key is pressed when the reset key is pressed. This lets non-programmers set or clear this bit, so existing programs with this problem may be initialized correctly.

Bit 4 of $FF98 is the monochrome bit and reflects some foresight on Tandy's part. It enables support for composite monochrome monitors, a monitor Tandy does not currently market. Bits *2 to 0 of $FF98* and bits 6 to 0 of $FF99 set up the resolution and number of colors used by the various Hi-Res GIME graphics modes.

$FF9A contains the color value for the display border. Normally this register is set to zero, so the display will have a black border like the Color Computers 1 and 2, but now the border can be set to any one of the 64 colors available via the GIME. More palette registers are found at locations $FF00 through $FFBF. They control the color set visible on the display.

Color Computers 1 and 2 can display up to eight colors. The GIME allows display of up to 16 colors at one time, chosen from a palette of 64. Color Computers 1 and 2 display one of a number of fixed color sets, but the GIME palette registers allow the programmer to pick and choose the colors used, for more realistic graphics.

$FF9C and $FF9F are the vertical and horizontal fine-scroll registers. They let the display scroll in either direction under hardware control — a feature that has yet to be used in any commercial software. An unfortunate bug in early production runs of the GIME chip rendered the horizontal-scroll register useless. These features may see some interesting applications once machines with later versions of the GIME chip become more widely available.

Locations $FF9D and $FF9E control the section of memory used by the GIME chip for its video. One nice thing about this 2-byte register: The section of memory used for the GIME's video need not reside in the current memory map.

This brings us to one of the GIME chip's most powerful features: the MMU. The 6809 CPU chip can only address 64K of memory at one time. This is an inherent limitation designed into the 6809 when memory cost more than it does today. To get around this limitation and make the 128K and 512K Color Computer possible, Tandy added the GIME's MMU feature.

On a 128K Color Computer 3, memory is available as sixteen 8K segments of memory. On a 512K machine, there are 64 of these 8K segments available. When the MMU is enabled, a set of eight registers in the GIME control which segment is addressed by the CPU. The MMU register at $FFA0, for example, controls which segment is seen in memory from addresses $0000 to $1FFF. The next register controls addresses $2000 to $3FFF. This scheme continues through the MMU register at $FFA7, which determines the segment to be mapped in at addresses $E000 through $FDFF. (Addresses $FE00 through $FFFF are a special case since the GIME chip is addressed in that range.)

There are two sets of MMU registers. The set at $FFA0 to $FFA7 is used if Bit 1 of $FF91 is zero; if it is one, the set at $FFA8 to $FFAF is used. This feature can be used to switch rapidly between two pre-defined sets of MMU values. In this manner, sections of memory can be switched into, and then out of, the 64K address space at will. Memory segments switched out of the space do not lose their contents and can even be switched back in at a different place.

The Color Computer 3's Super Extended BASIC uses the MMU to access high-resolution graphics areas outside the normal 64K address space. Much of the commercial software for the Color Computer 3 also uses the MMU to run a program larger than the 64K limit of the Color Computer 1 and 2. OS-9 Level II provides access to the full 128K or 512K of memory available with no special programming needed.

So there you have it — a quick look inside the GIME, the powerhouse chip inside our favorite new machine. There are many sources available for more information. Perhaps the best source of data on the GIME is Tandy's *Technical Reference Manual for the Color Computer 3*. Other sources of information are *Inside OS-9 Level II*, and the *BASIC Unraveled* series. Finally, there are many knowledgeable Color Computer users on the CoCo and OS-9 SIGs of online services like Delphi and CompuServe. Professional software developers have long known of the value such online services can provide. Delphi has many tutorial articles on 6809 programming and details on the GIME chip available in its CoCo SIG's online database.

Armed with this information, many of you may decide to tackle the world of assembly-language programming on the Color Computer — a task that is both challenging and rewarding to those willing to persevere. Perhaps this quick tour of the many powerful functions available via the Color Computer 3 GIME chip will inspire some of you to begin that journey.

(Questions or comments concerning this article may be directed to the author at 712 Brett, Rohnert Park, CA 94928. Please include an SASE when requesting a reply.)

> *"In the beginning there was VIP Writer and users saw that it was good, But it's not the best anymore. There's a new word processor to claim the crown...*
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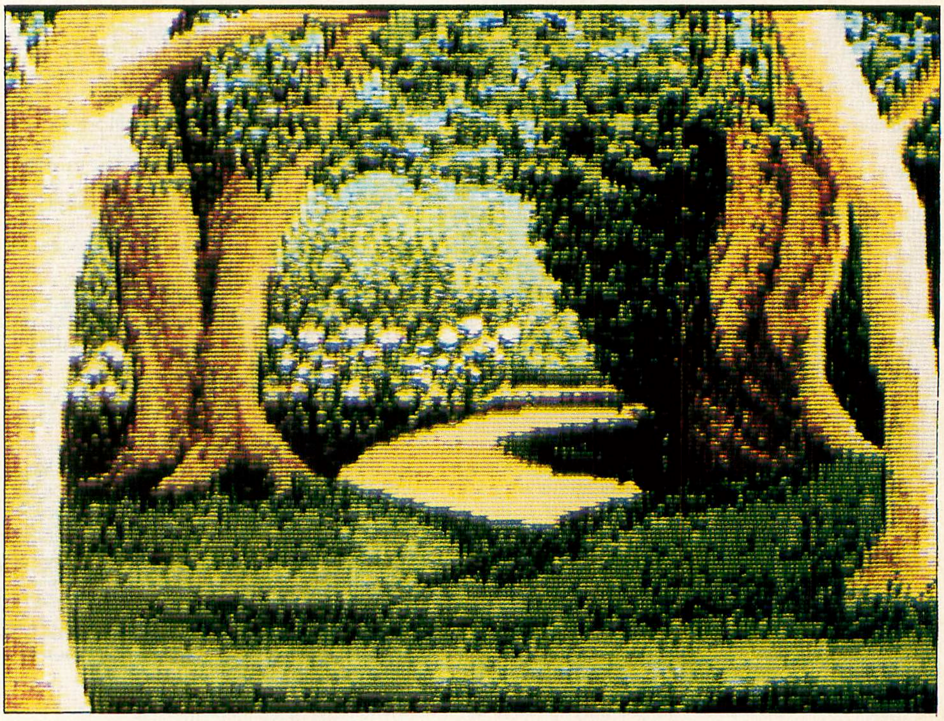
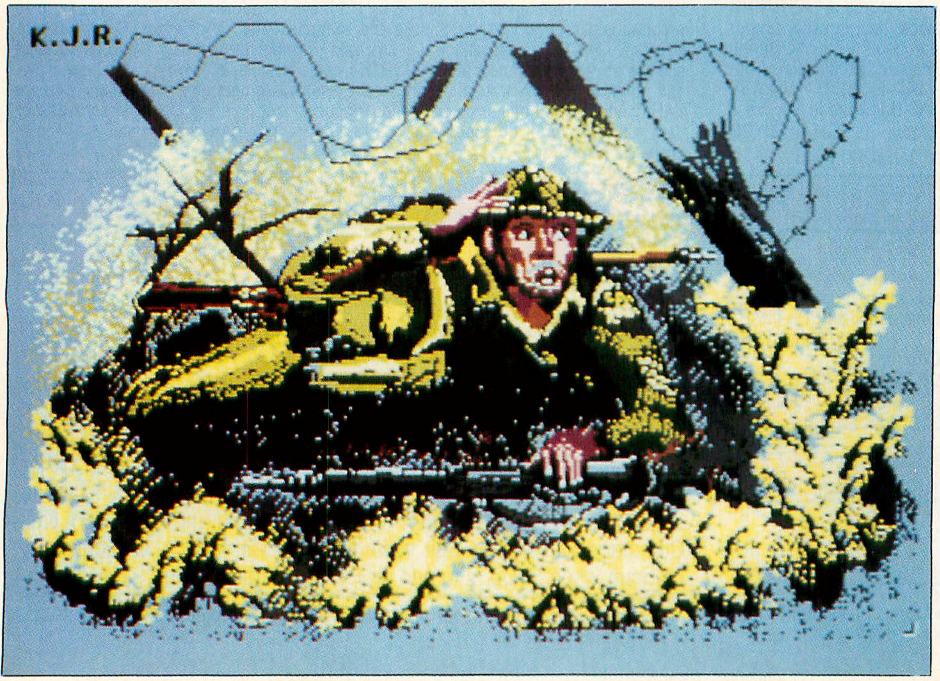
CoCo GALLERY



1st Prize

Parkview
Barbara Ann Storrier

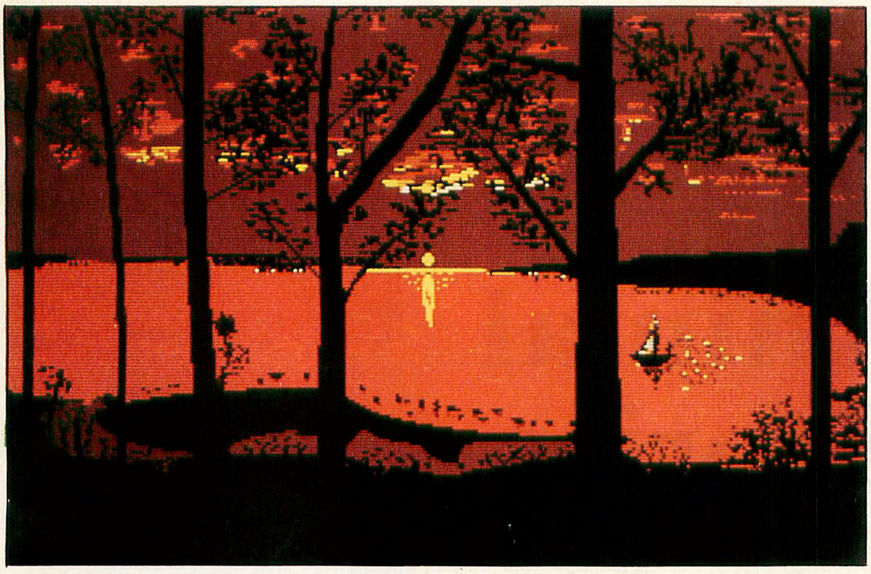
Drawn originally with pen & ink, Barbara recreated this landscape of Lacy Park in San Marino, California, on the CoCo 3. The striking realism showcases the features of *CoCo Max III* and the artist's talents. Barbara lives in Arcadia, California.



2nd Prize

War
Ken Robison

Breaking through the enemy's perimeter, this soldier moves closer to his objective. Ken, a citizen of Port Colborne, Ontario, designed this scenario via *The Rat* package.



3rd Prize

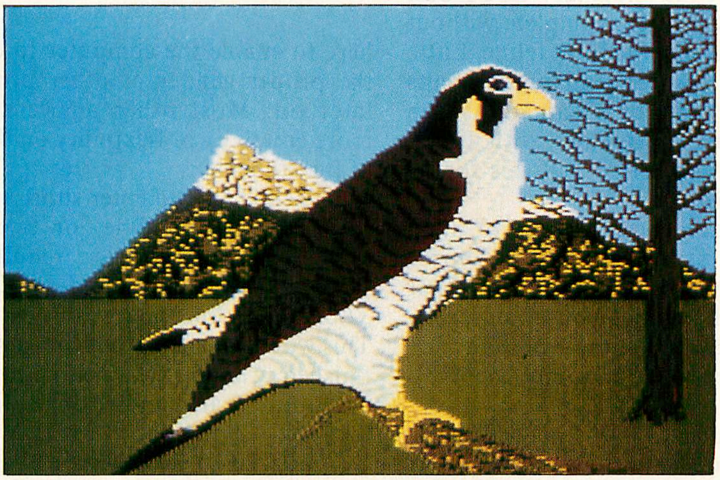
River
Joel R. O'Rear

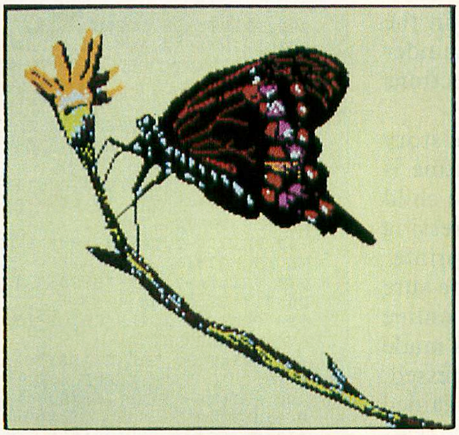
Red sky at night, sailors delight. Joel has enjoyed photography since his days in the Navy and now transfers his pictures to the computer with *CoCo Max III*. He lives in Tucumcari, New Mexico.

Honorable Mention

Faucon
Pierre Morris

This revered bird waits patiently for its prey. Pierre used a program he designed that enables him to obtain 256 different colors onscreen. He resides in Beauport, Quebec.





Honorable Mention

Butterfly
Brad Bansner

Although it isn't spring yet, I daydream of the plant life turning green again. Brad's *Colormax Deluxe* "Butterfly" is a welcome sight. A sophomore in high school, he sent this picture from Wyomissing, Pennsylvania.

SHOWCASE YOUR BEST! You are invited to nominate original work for inclusion in upcoming showings of "CoCo Gallery." Share your creations with the CoCo Community! Be sure to send a cover letter with your name, address and phone number, detailing how you created your picture (what programs you used, etc.) and how to display it. Also please include a few facts about yourself.

Don't send us anything owned by someone else; this means no game screens, digitized images from TV programs or material that's already been submitted elsewhere. A digitized copy of a picture that appears in a book or magazine is *not* an original work.

We will forward one first prize of $25; one second prize of $15 and one third prize of $10. Honorable Mentions may also be given.

Please send your entry on either tape or disk to the CoCo Gallery, THE RAINBOW, P.O. Box 385, Prospect, KY 40059. Remember, this is a contest and your entry will not be returned.

— Tony Olive, Curator

Those loving creatures that share our lives

Animal Stories

By Steve Blyn
Rainbow Contributing Editor

This month's program is a fun language arts program for elementary-school children. First and second graders will probably need assistance with some of the vocabulary words and spelling, but third graders and higher should have no trouble working on their own.

This program is concerned with pets. You know — those fuzzy, furry, obedient, curious creatures that share both our children's and our own lives. Pets are often considered full-fledged members of a family. Our own family has given its hearts to several pets over the years.

Even the computer world has fallen prey to this phenomenon. Look at the popularity of the imaginary CoCo Cat. No RAINBOWfest is complete without appearances from the furry feline. Little kids line up at these semiannual events to greet and hug CoCo Cat; adults stop to take pictures. Buttons with CoCo Cat's image are sold — all this for an imaginary mascot.

Things have gotten so out of hand that a new store called The Yuppie Puppy recently opened near Computer Island. In this store, you could easily spend a small fortune on pet clothing and gifts. Pets have certainly become a big business.

We have decided to write a program that kids can use to show their love for their pets — real or imagined. This program will help children create a short poem or story about a pet. If a printer is available, this poem or story will be printed on paper. Underneath the text is room to draw a picture of the real or imaginary pet.

The program first requests information about the child and the pet. These questions and answers are contained in lines 70 to 190. One by one, questions are asked, and the computer waits for the student to type an answer. A few of the answers had to be error-trapped. It is necessary, for example, for the child to type in either *boy* or *girl* for an answer on Line 120. The error-trapping is on lines 130 to 150. The program will not proceed until one of these responses is keyed in. A correct response is needed here to enable the computer to choose the proper gender of other pronouns later on. Most other answers allow more creativity or flexibility on the part of the student.

The child should enter short answers to the questions. One- or two-word answers are all that are required. If longer answers are entered, the CoCo's 32-character line limit will be exceeded. This would ruin the screen output of the finished product. (Naturally, the printer's output can handle longer lines of text.)

Lines 220 to 300 contain the directions for a printout of a story about the pet. The story's content is dependent on the child's answers to the questions. If there is no printer at hand, key in the program until Line 340. The remainder of the program contains the directions to print the story on any printer.

There are two options after the story appears on the screen. This routine is included on lines 310 to 320. The child may either end the program by pressing E or have the story printed on a printer by pressing P. As a precaution, be sure there is a printer connected and online before pressing E. If a mistake is made and the key is inadvertently pressed, control of the computer can be regained by pressing the Reset button on the rear-left side of the computer.

Experiment with any alterations you want or feel appropriate to your child's or pet's needs. You could change any of the questions or alter parts of the fixed content of the story. As always, we at Computer Island hope that you and your children enjoy and learn from our programs. □

Steve Blyn teaches both exceptional and gifted children, holds two master's degrees and has won awards for the design of programs to aid the handicapped. He owns Computer Island and lives in Staten Island, New York.

The Listing: PETSTORY

```
 10 REM"THE YUPPIE PUPPY"
 20 REM"STEVE BLYN,COMPUTER ISLAN
D,STATEN ISLAND,NY,1989"
 30 CLEAR 1000
 40 CLS:AA$=STRING$(32,191)
 50 PRINT@8,"PET    QUESTIONS";
 60 PRINT@32,AA$;
 70 PRINT@64,"WHAT IS YOUR FIRST
NAME ?":LINEINPUT A$
 80 GOSUB 210:PRINT"ARE YOU A BOY
 OR A GIRL?";:LINEINPUT Q$
 90 IF Q$="BOY" THEN R$="HIS" ELS
E IF Q$="GIRL" THEN R$="HER" ELS
E 80
 100 GOSUB 210:PRINT"WHAT KIND OF
 PET DO YOU HAVE?":PRINT"MY ";:L
INEINPUT B$
 110 GOSUB 210:PRINT"WHAT IS YOUR
 PET'S NAME?":LINEINPUT C$
 120 GOSUB 210:PRINT"IS "C$" A BO
Y OR A GIRL?":PRINT"A ";:LINEINP
UT D$
 130 IF D$="BOY" THEN X$="HE":Y$=
"HIS"
 140 IF D$="GIRL" THEN X$="SHE":Y
$="HER"
 150 IF D$<>"BOY" AND D$<>"GIRL"
THEN 120
 160 GOSUB 210:PRINT"HOW OLD IS "
C$"? ";:LINEINPUT E$
 170 GOSUB 210:PRINT"NAME ONE FOO
D THAT "X$" LIKES":PRINT"TO EAT
BEST. ";:LINEINPUT G$
 180 GOSUB 210:PRINT"NAME ONE THI
NG THAT "X$" LOVES":PRINT"TO DO
OFTEN. ";:LINEINPUT H$
 190 GOSUB 210:PRINT"WRITE SOMETH
ING THAT TELLS WHAT":PRINTC$" LO
OKS LIKE. ";:LINEINPUT I$
 200 GOTO 220
 210 PRINT@64,"":PRINT@96,"":PRIN
T@64,"";:PLAY"O3L80CEDFGGG":RETU
RN
 220 CLS:PLAY"O3L8CDEDC":PRINT@4,
A$;"'S YUPPIE ";B$
 230 PRINT@32,AA$
 240 PRINT@64,"MY PET'S NAME IS "
C$"."
 250 PRINT C$" IS A "D$" "B$"."
 260 PRINT@160,C$" IS "E$" YEARS
OLD AND"
 270 PRINT Y$" FAVORITE FOOD IS "
G$"."
 280 PRINT@256,X$" LOVES TO "H$".
"
 290 PRINT X$" LOOKS LIKE "I$"."
 300 PRINT@352,A$" WILL ALWAYS LO
VE "R$:PRINT "PET "B$" NAMED "C$
"."
 310 EN$=INKEY$
 320 IF EN$="E" THEN 330 ELSE IF
EN$="P" THEN 340 ELSE 310
 330 CLS:END
 340 REM"****PRINTING ROUTINE***"
 350 PRINT#-2,TAB(30)A$;"'S YUPPI
E ";B$:GOSUB 470
 360 PRINT#-2,TAB(25)"MY PET'S NA
ME IS "C$"."
 370 PRINT#-2,TAB(28)C$;" IS A ";
D$;" ";B$:GOSUB 470
 380 PREINT#-2,TAB(25)C$" IS "E$"
 YEARS OLD AND"
 390 PRINT#-2,TAB(28)Y$;" FAVORIT
E FOOD IS ";G$:GOSUB 470
 400 PRINT#-2,TAB(25)X$;" LOVES T
O ";H$;"."
 410 PRINT#-2,TAB(28)X$" LOOKS LI
KE "I$".":GOSUB 470
 420 PRINT#-2,TAB(25)A$;" WILL AL
WAYS LOVE "R$
 430 PRINT#-2,TAB(28)"PET ";B$;"
NAMED ";C$;".":GOSUB 470
 440 PRINT#-2,TAB(10)STRING$(60,"
-")
 450 PRINT#-2,TAB(25)"HERE IS A P
ICTURE OF MY PET"
 460 GOTO 310
 470 FOR T=1 TO 3:PRINT#-2," ":NE
XT T:RETURN
```

Telewriter-128™

the Color Computer 3 Word Processor

TELEWRITER: UNDISPUTED #1

If you've read the other word processor ads, you've probably had your fill of cold lists of features, and claims of ultimate speed, power, and ease of use. So let's try to get past the overblown claims and empty buzz words—with 2 simple facts:

Fact 1: Telewriter is undisputedly the #1 most popular word processor on the Tandy Color Computers.

Fact 2: Telewriter's exemplary ease of use and power have been acclaimed in numerous magazine reviews and in thousands of letters and calls from end users.

THE OTHERS DON'T UNDERSTAND

So why has Telewriter gained such a large and loyal following, while other Color Computer word processors have come and gone? Ironically, our competitors' ads tell you *exactly* why.

For them, word processing is nothing more than features and numbers. The longer the list of features, and the bigger the numbers, the better the word processor. Or so they think.

They just don't understand that power and ease of use are not gained by tacking on random features or throwing in freebie utilities or forcing you to use a cumbersome mouse.

Real Power, *true* Ease of Use, and *genuine* Speed can only be attained through thoughtful, logical, intelligent design, attention to detail, and a commitment to the act and the art of writing. That's the Telewriter tradition, and that's the reason for Telewriter's phenomenal success.

TELEWRITER—128: INTELLIGENT DESIGN PERFECTED

And now, Telewriter-128, the latest Telewriter, uses the added hardware power of the Color Computer 3 to bring this intelligent design to its logical perfection.

Telewriter-128 adds unsurpassed speed and important new features to the already impressive arsenal of Telewriter-64. Not just speed for speed's sake, or features for the sake of advertising—but speed where it counts and features that make you a more efficient, more effective writer.

Rainbow magazine put it this way: "Telewriter-128 will set the word processing standard for the Color Computer 3 because it is so simple and user friendly. . . . The 81-page tutorial/user's manual is nicely done. It is written in easy to understand language but the program itself is so easy. . . . Most people will be able to use the software right out of the package."

TELEWRITER-128 OR DESKTOP PUBLISHING

Desktop publishing is nice for adding pictures and fancy fonts to newsletters or business presentations—but its graphics orientation sacrifices some important capabilities when it comes to working with words.

If your main concern is expressing ideas through words (notes, letters, reports, papers, novels, etc.), the dedicated word processing power of Telewriter-128 still provides the most efficient tool for the job. Each tool has its place—desktop publishing for striking visuals, Telewriter-128, for effective writing.

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You can no longer afford to be without the ease, power, and efficiency, that Telewriter brings to everything you write.

Telewriter-128 for the Color Computer 3 costs $79.95 on disk, $69.95 on cassette.

For the Color Computer 1&2, **Telewriter-64** costs $59.95 on disk, $49.95 on cassette.

To order by MasterCard or Visa,
call **(619) 755-1258** anytime, or send check to:

COGNITEC
704 Nob Avenue
Del Mar, CA 92014

(Add $2 S&H. Californians add 6% tax. To upgrade from TW-64 to TW-128 send original TW-64 disk and $41.95.)

Telewriter is also available through your nearby Radio Shack Computer Center and participating Radio Shack stores and dealers—or order direct from Express Order by dialing **1-800-321-3133.**

Ask for: **Telewriter-128** (disk) . . . cat #90-0909
Telewriter-64 (disk) . . . . cat #90-0254
Telewriter-64 (cass) . . . . cat #90-0253

FEATURES THAT MATTER: Telewriter's outstanding design and its complete set of features, put it in a class by itself, for smooth, efficient writing and letter perfect printed documents. Telewriter-128 includes:

Unbeatable SCREEN PERFORMANCE: lightning fast paging and scrolling, on-screen text that never lags behind your typing, and a response that is always instantaneous, no matter how much text is in the buffer, or where you are in the document.

26 User definable MACRO KEYS type your often used phrases and titles with a single keypress—saving you time and freeing your concentration for writing. User settable DUAL SPEED CURSOR moves you anywhere on the line, on the page, or in the document, fast or slow—you decide, with the touch of a finger. Fast PRINT PREVIEW MODE shows you text as it will print: headers, footers, margins, page breaks, page numbers, justification—saves time and paper and guarantees perfect looking documents everytime.

Instant, ON-LINE HELP summarizes all Telewriter-128 commands and special symbols. The On-line OPTIONS MENU lets you instantly customize the writing environment at any time to suit your precise needs (Screen/character color, Monochrome on/off, Key repeat/delay rate, 2 Cursor repeat/delay rates, Case-sensitivity of search, Auto file backup on/off, and more). A SINGLE FUNCTION KEY takes you instantly to any menu, so you never have to stop and think.

The 24, 25 or 28 LINE SCREEN DISPLAY option lets you see 16% more on-screen text (28), or wider line spacing (25). The auto-loading OPTIONS FILE stores all your Macros, Print Format settings, and Options Menu settings, so they are always there everytime you run Telewriter-128. 3 pop-up STATUS WINDOWS tell you cursor position, word count, free space, etc.

The QUICK SAVE feature lets you instantly save your current document with just 2 keystrokes and without leaving the editor. CURSOR THROUGH DIRECTORY to Load, Append, Rename and Kill files—so you'll never type a filename after the first time. HANGING INDENTS help you organize ideas on the page more effectively. Also: Footers, Multiple Print, Print to Disk, Key Click, Key Repeat, 40/80 Column Option, Overstrike, Word Delete, Nested Macros, Definable Foreign and Math Symbols and more. . . .

And, of course, Telewriter-128 incorporates all the Features of TELEWRITER-64, like: Works with *absolutely any printer* that works with your Color Computer (1, 2, or 3). Uses simple Embedded Control Codes so *all* intelligent features of your printer are easily accessed, including: Underlining, Boldface, variable Fonts, Sub-script, Super-script, Italics etc.

Format commands allow dynamically changing Margins, Headers, Spacing, Centering, etc., anywhere in the document. Format menu sets Margins, Spacing, Page numbering, Baud rate, Lines per page, Justification. Chain Printing means the size of your printed document is unlimited. Also Single page and Partial Print.

Fast full-screen editor with wordwrap, text alignment, block copy/move/delete, global search and replace, wild card search, fast 4-way auto-repeat cursor, fast scrolling, forward and backward paging, settable tabs, word and line counter, full error protection. Insert or delete anywhere on screen. Simple, easy to remember, "mnemonic" Editor Commands. Load, Save, Append, Partial Save files to disk or cassette. Kill, rename and list disk files. ASCII file compatibility.

The ninth in a series of tutorials for the beginner to intermediate machine language programmer

Machine Language Made BASIC

Part IX: Let There Be Music

By William P. Nee

The Color Computer is adept at producing musical sounds. Complicated and expensive hardware can replicate almost any musical instrument and play over many octaves with several voices. This month we'll explore the `SOUND` and `PLAY` commands and execute them from machine language programs. In a later article, we'll learn how to play music with up to six voices (notes) at one time. However, for right now, let's stick to one note at a time.

Let's start with the `SOUND` command. To use this command in BASIC, you need to enter a note (1 to 255), followed by the duration of play. Table 1 gives each note and its corresponding number. Middle C is `C4`, with a value of 89. These values can only approximate the note's actual frequency, but they will produce a good sound.

Load Register A with the desired sound and Register B with the duration; store A in Location $8C and execute the `SOUND` command at Address $A951. Please note: You'll lose anything stored in registers A and X. Routine 1 plays every note from 1 to 255. A sine-wave table of 36 notes (used in cassette programs) starts at Address $A85C. If you want to play these notes, try Routine 2.

Notes	Octave 3	4	5	6	7
C	---	89*	176	218	239
C#/D-	---	99	180	221	241
D	---	108	185	223	242
D#/E-	---	117	189	225	243
E	---	125	193	227	244
F	5	133	197	229	---
F#/G-	19	140	200	231	---
G	32	147	204	232	---
G#/A-	45	153	207	234	---
A	58	159	210	236	---
A#/B-	69	165	213	237	---
B	78	170	216	238	---

*Middle C

Table 1: SOUND Notes

To play a tune with notes of different durations, make up your own note table of two bytes for each note and its duration. Load Register A with the note and Register B with its duration, then play the note. Decrease the note counter and continue until out of notes. Playing notes can also be integrated with your visual display, but that will slow down the tempo.

The `PLAY` command is more complicated and requires more set-up. It uses the following locations:

Location	Description
$D8	Number of notes, pauses, etc.
$DE	Octave (0 to 4)
$DF/E0	Volume
$E1	Note length
$E2	Tempo
$E5	Number of dots after length

Each note is numbered from one to 12 since there are 12 half-steps in an

---

Bill Nee bucked the "snowbird" trend by retiring to Wisconsin from a banking career in Florida. He spends the long, cold winters writing programs for his CoCo.

```
               ORG    $3000
SOUND          LDD    #$0101          NOTE = 1, DURATION = 1
AGAIN          STA    $8C
               PSHS   A               SAVE NOTE
               JSR    $A951           SOUND NOTE
               PULS   A               GET NOTE
               INCA   NEXT NOTE
               CMPA   #$FF            TOP NOTE?
               BLO    AGAIN           IF LOWER, AGAIN
               SWI
```

Routine 1: Playing the Notes

```
          ORG    $3000
START     LDY    #$A85C      ADDRESS OF NOTE TABLE
          LDB    #1          NOTE DURATION
          LDA    #36         NUMBER OF NOTES TO PLAY
          STA    NOTES       SAVE IT
LOOP      LDA    ,Y+         GET A NOTE
          STA    $8C
          JSR    $A951       PLAY THE NOTE
          DEC    NOTES       ONE LESS TO PLAY
          BNE    LOOP        IF NOT OUT OF NOTES, BACK TO LOOP
DONE      SWI
NOTES     RMB    1
          END    START
```

Routine 2: Notes From a Sine-Wave Table

Note	**Location**				
	O0	O1	O2	O3	O4
	$9C62	$9C7A	$9C92	$9C9E	$9CAA
C	#$1A8	#$0D3	#$A6	#$51	#$26
C#	#$190	#$0C7	#$9C	#$4C	#$23
D	#$17A	#$0BB	#$93	#$47	#$21
D#	#$164	#$0B1	#$8B	#$43	#$1F
E	#$150	#$0A6	#$83	#$3F	#$1D
F	#$13D	#$09D	#$7B	#$3B	#$1B
F#	#$12B	#$094	#$74	#$37	#$19
G	#$11A	#$08B	#$6D	#$34	#$18
G#	#$10A	#$083	#$67	#$31	#$16
A	#$0FB	#$07C	#$61	#$2E	#$14
A#	#$0ED	#$075	#$5B	#$2B	#$13
B	#$0DF	#$06E	#$56	#$28	#$12

Table 2: PLAY Delay Cycles

Volume:	$DF/E0:	Volume:	$DF/E0:
V31	#$FA02	V30	#$F606
V29	#$F20A	V28	#$EE0E
V27	#$EA12	V26	#$E616
V25	#$E21A	V24	#$DE1E
V23	#$DA22	V22	#$D626
V21	#$D22A	V20	#$CE2E
V19	#$CA32	V18	#$C636
V17	#$C23A	V16	#$BE3E
V15	#$BA42	V14	#$B646
V13	#$B24A	V12	#$AE4E
V11	#$AA52	V10	#$A656
V9	#$A25A	V8	#$9E5E
V7	#$9A62	V6	#$9666
V5	#$926A	V4	#$8E6E
V3	#$8A72	V2	#$8676
V1	#$827A	V0	#$7E7E

Table 3: PLAY Volume

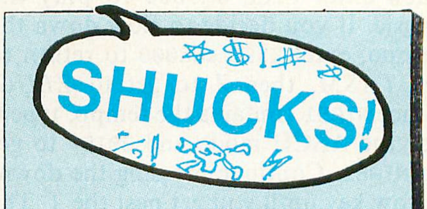
octave (C natural, C sharp/D flat, D natural, D sharp/E flat, E natural, F natural, F sharp/G flat, G natural, G sharp/A flat, A natural, A sharp/B flat and B natural).

There are five available octaves, but the computer subtracts one from the octave number, giving us octaves 0 to 4. The frequency table for the five octaves begins at $9C62. (See Table 2). The volume is a two-byte number corresponding to `V31`, `V0` (Volume 0) in BASIC. Table 3 gives the BASIC volume and the corresponding number that goes in locations $DF and $E0. The first number is 126 plus four times the volume; the second number is 126 minus four times the volume.

The length can be any value between 1 and 255. Adding a dot after the value increases the value by one half. The common notes and their lengths are as follows:

Note	**Length**
Whole	L1
Half	L2
Quarter	L4
Quarter Triplet	L6
Eighth	L8
Eighth Triplet	L12
Sixteenth	L16
Sixteenth Triplet	L24
Thirty-second	L32
Thirty-second Triplet	L48

The tempo can be any number between one and 255. The computer defaults to a tempo of two at power-up. Use the same length values as above for



You spent $60 to $80 for your CoCo 3 Word Processor and now the incredible Max-10 comes along!
We know the feeling, so we have a special offer for you, but you have to find the "GOOD NEWS" ad somewhere in this issue.
Do you know that with Max-10, word processing is actually fun? (Hard to believe, huh?)

COLORWARE 203 656 1806

a pause or rest. A pause actually plays a note, but at `V0`. The number of notes and pauses to be played goes into Location $D8, and the location of your note table goes into $D9/DA. Since $D8 is a one-byte location, you cannot have a note table of more than 255 notes. Any more will require a second note table.

The `PLAY` command goes from Address $9A22 to $9CB5, taking up 660 bytes — quite a routine. Fortunately there is a way to get around entering individual volumes, tempos, notes and lengths. This method involves loading your note table location into Location $A6/A7 (the current pointer location) and creating a note table using the *EDTASM* FCC (Form Constant Character) op code. The note table must start and end with quotes, just as the `PLAY` command would. Use all the `PLAY` command notations, such as notes A to G, octaves 1 to 5, lengths 1 to 255, tempo, pause, etc. After using the `PLAY` routine at $9A22, reload Location $A6/A7 with its original value. This routine *cannot* be executed from *ZBUG*; you must be in BASIC. Remember: Once you go to BASIC, your machine language program buffer is lost. It's still in *ZBUG*, but the source code has vanished. Try Routine 3; notice that `NTAB1` starts at $301D and `NTAB2` starts at $3056. Jot down those locations if you want to correct or change any notes. While in *ZBUG*, use the A mode to find that the last byte used (' ') is at $30CE. If you want to add any more notes, they would have to start after that location.

When there are no errors in the source code, enter Q to return to BASIC, then enter `EXEC &H3000` to play the music. If you decide to slow down the tempo, enter `EXEC &HC000` to return to *EDTASM*, then Z to get to *ZBUG*. Since `NTAB1` contains the tempo, type `A` for the ASCII mode and `301D/` to get to `NTAB1`. Continue pressing the down-arrow key until you get past the T. The next byte contains the original tempo of 4. Enter `3E` to change the tempo and return to the edit mode, then press Q to return to BASIC. Type `EXEC &H3000` again, and the same music plays — but at a slower speed.

When you first power up, the subroutine at Address $829C sets the octave (O3), the volume (V15), the length of the note (L4) and the note's tone (T2). Unless you're going to change one of these, you don't need to enter them. Regardless of what any manual states, the scale goes from C to B in each octave.

```
         ORG  $3000
START    LDX  $A6         SAVE CURRENT POINTER LOCATION
         PSHS X
         LDX  #NTAB1      REPLACE IT WITH NOTE TABLE 1 LOCATION
         STX  $A6
         JSR  $9A22       PLAY NOTE TABLE 1
         LDX  #NTAB2      REPLACE IT WITH NOTE TABLE 2 LOCATION
         STX  $A6
         JSR  $9A22       PLAY NOTE TABLE 2
         PULS X           GET OLD POINTER AND PUT IT BACK
         STX  $A6
         RTS              RETURN TO BASIC
NTAB1    FCC  /"T4V30O3L4CP100C/
         FCC  /GP100GAP100AGP100G/
         FCC  /FP100FEP100E/
         FCC  /DP100L8.DL16EL2C"/
NTAB2    FCC  /"L4GP100GFP100FEP100E/
         FCC  /DP100DGP100GFP100F/
         FCC  /EL100FEDL8.EL10F/
         FCC  /L4EDCP100CGP100GAP100A/
         FCC  /GP100GFP100FEP100E/
         FCC  /DL100EDCL8.DL16EL2C"/
         END  START
```

Routine 3: Replacing Locations

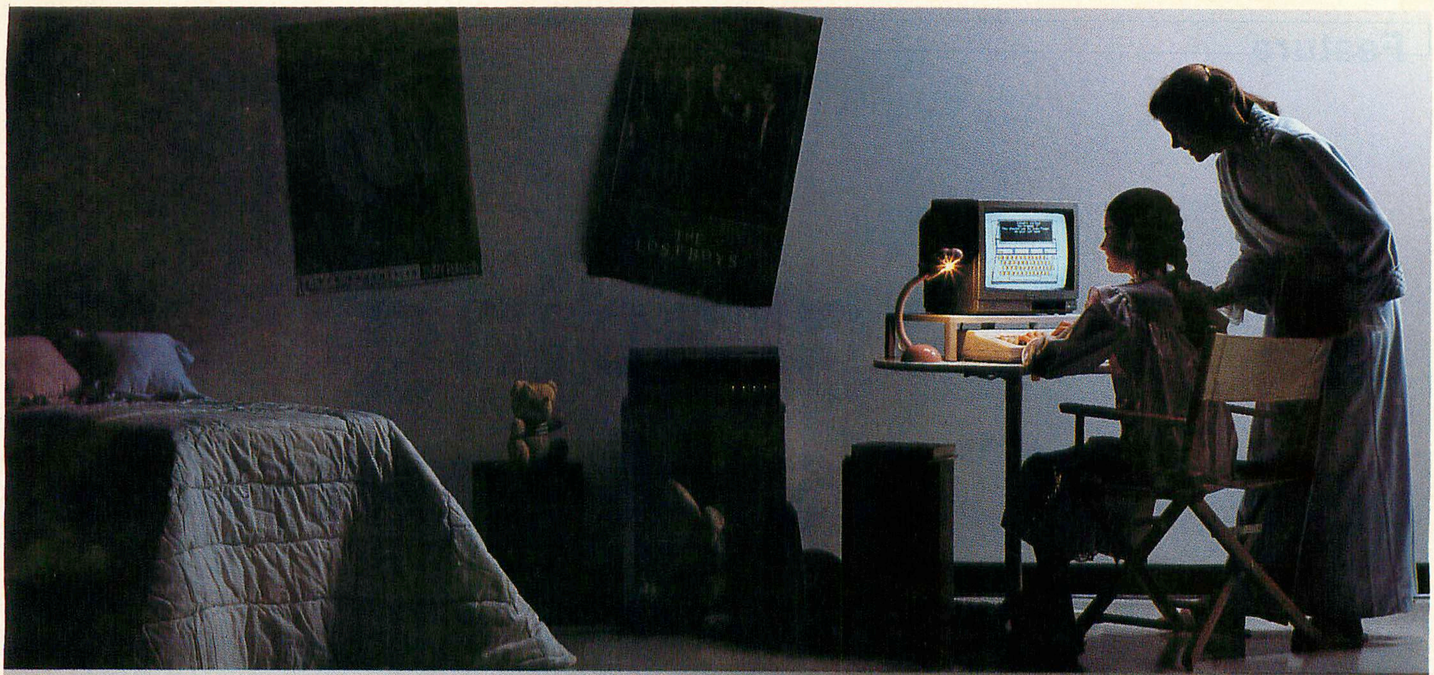
The Listing: `MLNOTES`

```
3000                00100          ORG    $3000
3000 9E    A6       00110 START    LDX    $A6
3002 34    10       00120          PSHS   X
3004 8E    3019     00130          LDX    #NTAB1
3007 9F    A6       00140          STX    $A6
3009 BD    9A22     00150          JSR    $9A22
300C 8E    3058     00160          LDX    #NTAB2
300F 9F    A6       00170          STX    $A6
3011 BD    9A22     00180          JSR    $9A22
3014 35    10       00190          PULS   X
3016 9F    A6       00200          STX    $A6
3018 39             00210          RTS
3019       22       00220 NTAB1    FCC    /"T4V30O3L4CP100C/
3029       47       00230          FCC    /GP100GAP100AGP100G/
303B       46       00240          FCC    /FP100FEP100E/
3047       44       00250          FCC    /DP100L8.DL16EL2C"/
3058       22       00260 NTAB2    FCC    /"L4GP100GFP100FEP100E/
306D       44       00270          FCC    /DP100DGP100GFP100F/
307F       45       00280          FCC    /EL100FEDL8.EL10F/
308F       4C       00290          FCC    /L4EDCP100CGP100GAP100A/
30A5       47       00300          FCC    /GP100GFP100FEP100E/
30B7       44       00310          FCC    /DL100EDCL8.DL16EL2C"/
           3000     00320          END    START

00000 TOTAL ERRORS
```

My program offers a simple tune, but don't stop with my tune. The musical possibilities are endless. You only need a CoCo, some imagination and some patience.

Questions or comments about this tutorial may be directed to the author at Route 2, Box 216C, Mason, WI 54856-9302. Please enclose an SASE when requesting a reply.)



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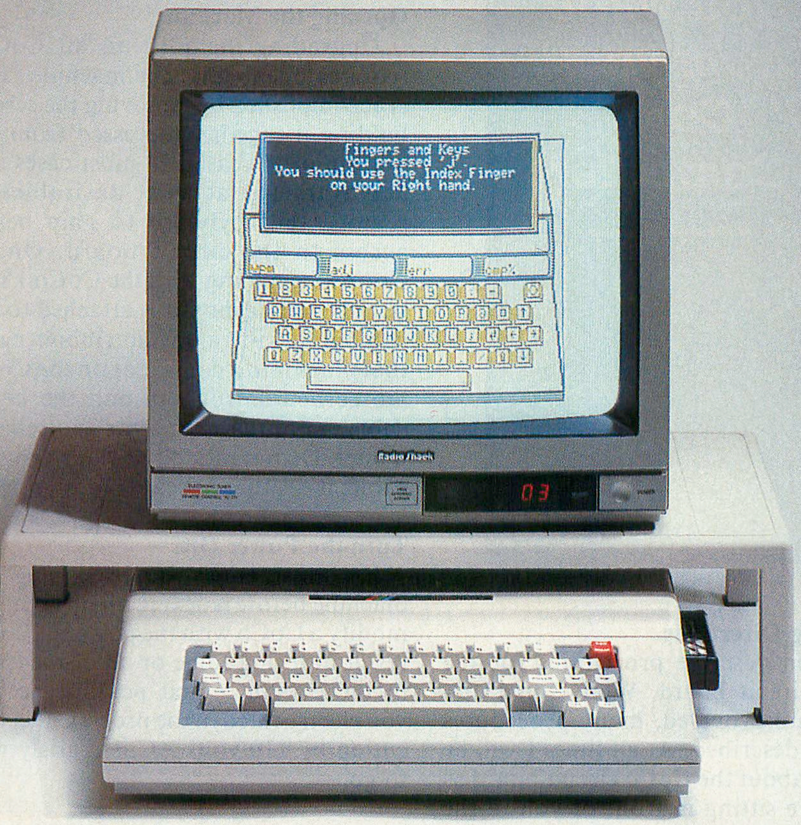

```
Fingers and Keys
You pressed 'J'
You should use the Index Finger
on your Right hand.
```

Get real computing power with the Tandy Color Computer 3. Connect it to your TV and you'll have your own home computer system—for just $199.95.

With the educational software available for the Color Computer 3, your children can study math, reading, typing—a variety of subjects—all while learning how to use a *real* computer.

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Upgrading CoCo's Memory

By Martin H. Goodman, M.D.

Probably one of the simplest things CoCo owners can do to improve the utility and performance of their machines is adding more memory. All it takes is the right chips and tools and a few modifications to your computer. Usually memory upgrades can be done by CoCo owners with a little help from Tandy or a third-party vendor. This article discusses things to consider before upgrading memory, offers the general procedures for upgrading memory, and gives brief technical reviews of the various products on the market.

The Warranty

Some of the procedures I discuss involve opening your CoCo. Please note: Opening the computer can void the warranty, so if your machine is under warranty you may want to wait until that warranty has expired. More adventurous users may want to run their machines continuously for 72 hours. If no trouble arises, these hardy souls may assume with *some* degree of confidence that their warranties will not be needed and open their machines.

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

How to get everything you want from your Color Computer

Defining Directions

I often describe procedures for the CoCo circuit board. While some diagrams are provided, many procedures are just described. At all times I will be talking about the CoCo circuit board as if it were sitting in front of you in the CoCo case with the keyboard (or the space where the keyboard was) facing you — as if you were about to type on an intact CoCo. When I say *front*, I mean "toward the keyboard," and when I say *rear* or *back*, I mean "toward the back of the computer, where the power and reset switches, and joystick, cassette and serial port connectors are located." Similarly, *right* means "toward the system bus (ROM pack) connector," and *left* means "toward the power supply side of the circuit board."

Opening the Machine

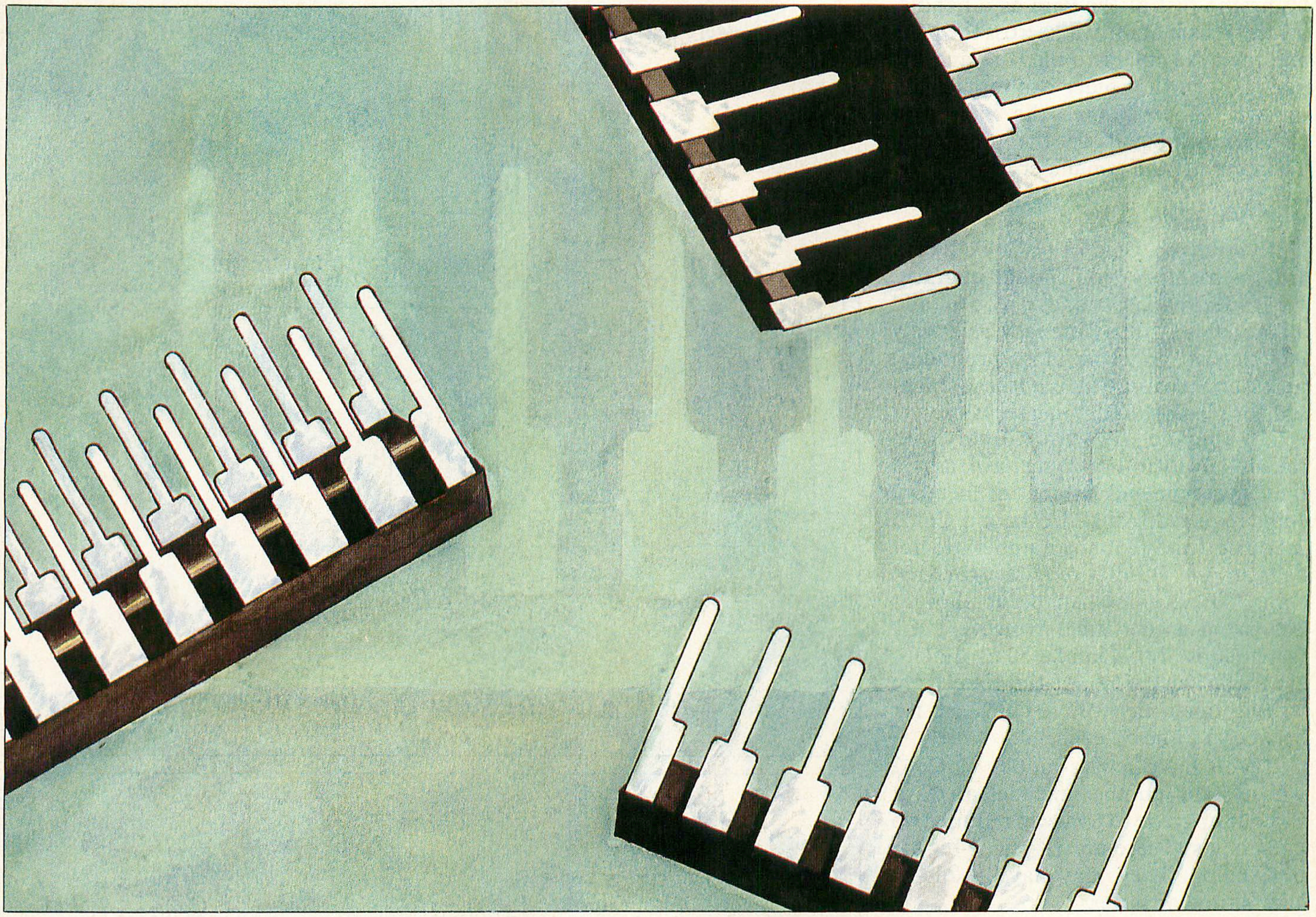
Upgrading memory on all CoCos requires opening up the machine. This is accomplished by removing the screws holding it together (accessed from the bottom of the case). In most cases it is necessary (or at least desirable) to remove the keyboard to gain better access to the circuit board. On all CoCos, beginning with the CoCo 1's "F board," the keyboard is attached to the computer with a mylar ribbon cable that plugs into a connector on the CoCo motherboard. You can pull the mylar cable out of this connector and reinsert it later. Do not scratch or tear the mylar cable; it's rather delicate.

Turn the Power Off!

Let me remind you to *unplug* the machine before working on it. Trying to modify a CoCo with the power on could result in frying some or all of the chips in the computer and possibly getting you electrocuted in the process. Electrocution by 110 volts AC is a grisly way to go.

Put the Chips in the Right Way

Plugging in a chip upside down can destroy the chip, so plug in the chips



correctly. Chips are typically oriented using either a notch or a dot (or both) at one end of the chip. This mark should correspond to the notch on the socket for that chip, to the notch on the silkscreen or to the part of the socket that has one corner filed down. On *most* CoCo models, all chips point the same way. Use this information to guide your placement of new chips. However, this information cannot be used when putting a new ROM chip into models A and B of the CoCo 2. In that situation, pay attention to the marks on the chip and the socket in which it goes.

You will need a Phillips screwdriver to open up the CoCo's case. In addition, you need a soldering iron and solder for almost all CoCo 1 and 2 upgrades. A temperature-controlled or low-wattage (15 to 25 watts) pencil iron with a small tip is essential. Some upgrades require cutting pliers, and most of the upgrades need needle-nosed pliers and a short piece of wire.

ROM and RAM chips are sensitive to static electricity. They are usually shipped in anti-static tubes or on anti-static foam pads. Make sure you and the foam surrounding the RAM chip have touched the ground plane on the CoCo before you handle or insert the chips. This will bring you, the CoCo and the chip to the same potential. Be careful in dry, cool environments, especially if you are on a thick rug. In such situations, it may be necessary for you to ground yourself to a water pipe via a conductive wrist band before working on the machine. Be sure the machine's ground and the foam-padded chips are brought to the water-pipe ground, too.

The best tool for removing memory chips from their sockets is a small screwdriver, which can be slipped between the chip's body and the socket and then rotated to gently pull up first one and then the other side of the chip. Occasionally a chip will be in a position not easily reached with a screwdriver. In this case, you may want an IC extractor tool. Radio Shack sells its extractor in combination with a IC inserter tool (Cat. No. 276-181, $6.95); however, many electronic supply houses sell an extractor for $2 or less. The extractor is a U-shaped piece of resilient metal with little teeth at the end of the U. Slip the teeth under the IC at both ends and use a rocking motion to remove the chip. Caution: It is easy to misuse the tool — especially when attacking a "stuck" chip. Be careful.

When inserting chips in the sockets, first put the chip on its side and gently bend the pins a little inward. Brand-new chips are often supplied with the pins angled out a bit, which makes it difficult to insert them. When inserting the chip, make sure all pins go into the holes of the socket. It is easy to leave one pin sticking out or (worse) bend a pin under the chip.

Many of these upgrades call for you to solder wire across two adjacent solder pads on the motherboard of the CoCo. Often the wire should be an eighth of an inch long — or less. Handling such short pieces of wire can be quite difficult. I recommend you jumper such pads in the following manner: Strip a bit of the insulation off a piece of 24-, 26- or 30-gauge wire. Then bend it at its end, so the length you want to use is bent in an L shape. Now *tin* that end of the wire, and put a little blob of solder on the two pads you need to join. Using the rest of the wire as a handle, lay the L part of the wire across the pads and melt the solder to the wire and the pads. When the solder has thoroughly melted, flowed over the wire and bonded to the pads, let the joints cool. Then cut off the remainder of the wire.

CoCos 1 and 2

If you own a CoCo 1 or CoCo 2 with 16K of memory, you should upgrade. Upgrades for late-model CoCo 1s and all models of CoCo 2 are easy, relatively inexpensive and (for most programs) necessary because 64K is now the standard for CoCo 1 and 2 memory.

The upgrade procedure will vary with the model CoCo 1 or 2 you have, as will the exact type and number of memory chips required. All CoCo 1s and CoCo 2s whose Tandy catalog numbers do not have an A or B suffix require eight 4164 chips. These chips can be as slow as 200 ns in access time. However, any faster chips of that kind (150 ns, 120 ns, etc.) will work fine. At the time I am writing this article, these chips sell for between $1 and $2 each.

If you have a late-model CoCo 2 whose serial number includes an A or B, your upgrade to 64K will require two 4464 chips. These are 18-pin, 4-bit-by-64K chips. They may have a 200-ns access time or faster.

CoCo 1 C-, D- or E-Board Computers

These large Color Computers came with a *chicklet* keyboard and a gray case. When opened, they have a keyboard connected to the motherboard at a 16-pin connector. At the front-right side of the computer, you will see a multidigit number followed by the letter C, D or E. C-board computers will also have a satellite board connected to the main board via a cable. For all but the most fanatic hackers, the C-board upgrade can be considered impossible. C-board computers are rare and should not be upgraded but considered museum pieces.

D- and E-board CoCos can be upgraded to 64K, but the procedure is tedious, especially for the D board. These upgrades were covered in past issues of THE RAINBOW (see "ROM-RAM Roundup," May 1984, Page 49) and space does not permit my rehashing those instructions. Problems arise because the D-board CoCo 1 was not designed to support any more than 16K of memory. The E-board CoCo 1 was designed to support 64K memory chips but was not designed to use more than 32K of those chips. Thus extensive modifications to the chip power supply and address lines and the addition of an extra logic gate in the memory circuitry is required to accomplish the upgrade of those machines. The E-board CoCo 1 was designed to accept half-bad (optimists call them half-good) 64K memory chips (sometimes mistakenly called 32K-RAM chips), which Tandy bought at a discount. The board even had a jumper, so Tandy could populate it with chips that had either their top or bottom halves intact.

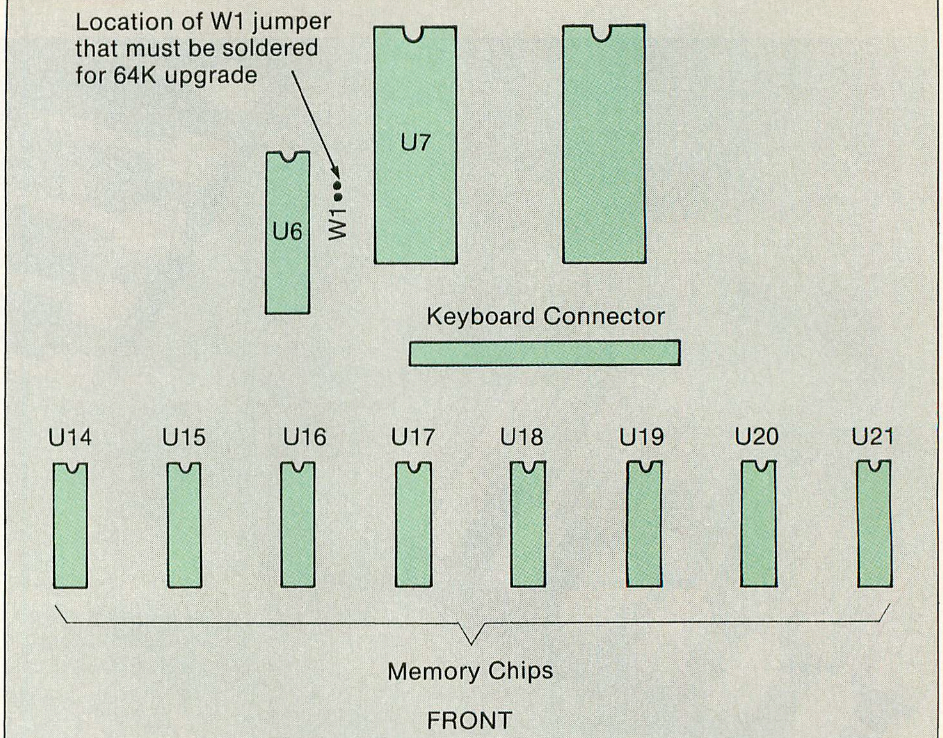


Figure 1: CoCo 2 (26-3026) Memory Upgrade

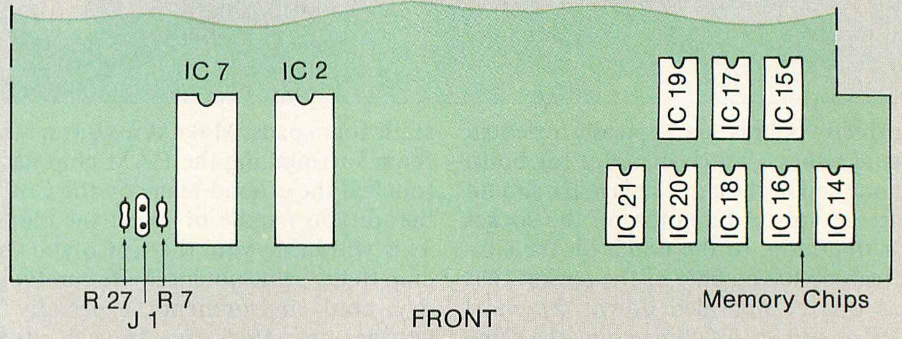


Figure 2: Memory Upgrade of CoCo 2 (26-3134 and 26-3136) Showing Location of J1 and of the Eight Memory Chips

The CoCo 1 F-board (Cat. Nos. 26-3002A, 26-3003A and 26-3004A) was the first Color Computer made by Tandy designed from the start to be upgraded to 64K of memory. The 3002A and 3003A models require memory upgrading. They are large computers, like the CoCo 1 C-, D- and E-board machines. The CoCo 1 F board did not actually have the letter *F* on its circuit board. Rather, it had either no letters at all, or the phrase *REV NC* was silk-screened on it. However, because it followed the CoCo C, D and E boards, CoCo owners refer to it as the F-board CoCo 1. The machine came in a beige case with a keyboard somewhere between the old CoCo chicklet keyboards and the later keyboards. This was a low-profile keyboard, with keys that looked as if they had been melted down. Early F board units were also gray and had the chicklet keyboard. Tandy marketed the same machine in a square white case as the TDP 100 computer.

This computer's upgrade consists of removing the metal shield that hides the 74LS783 chip and the eight DRAM chips. This shield is attached with little tabs, some of which can be removed by moving your finger around under the circuit board. With most of the tabs unbent, the shield can be removed from above. You then remove the old 16K DRAMs (U21 through U28) and cut out capacitors C58, 60, 62, 64, 66, 68, 70 and 72. Insert the eight 4164 DRAMs in the sockets you just cleared. Two sets of three staking pins are located to the left of the DRAM chips. Each has a jumper that connects the middle pin to one of the two side pins. These jumpers should be moved from the 16K position to the 64K position. Another set of three pins is to the right of the DRAM chips. This set also needs to have its jumper moved from the 16K to the 64K position. (Note: If you fail to move all three of these jumpers, you will probably burn out your new DRAM chips.) A fourth jumper needs to be added (not moved). This jumper must connect two pins labeled *64*, found to the left of U17 (the 6821 chip). Serious hackers will remove the jumpers entirely and solder the appropriate pins together.

CoCo 2s

If you own an American-made, original CoCo 2 (Cat. No. 26-3026 or 3027) with 16K of memory, open the computer and remove all eight socketted 16K DRAM chips. These are located in the front of the computer in a single row of eight chips and are numbered U14 though U21. Replace them with 4164 chips. Now find U7, a 40-pin 6822 chip in the center of the board, toward the rear. Just to the left-front of U7 (bottom of the chip), you will find two adjacent solder pads labeled *W1* on the circuit board.

These two pads are close together and oriented front to back. Jumper these two pads together, using a tiny bit of wire and a soldering iron. When you have jumpered them, the jumper wire will run parallel to U6 and U7. That's all there is to it — your upgrade is complete. (See Figure 1 for details.)

If you own one of the first Korean-made CoCo 2s (Cat. No. 26-3134 or 26-3136), you need eight 4164 chips. Upgrade the memory on your computer in the following manner: Open your machine. You will find eight socketted 16-pin 16K DRAM chips, which are in two rows (one of five and one of three chips). Remove those chips. Immediately to the left of IC-7, between R27 and R7, you will see two solder pads labeled *J1*. Solder a jumper between those two pads. This jumper will run front to back and join the two J1 pads. That's all there is to this upgrade. (See Figure 2 for details.)

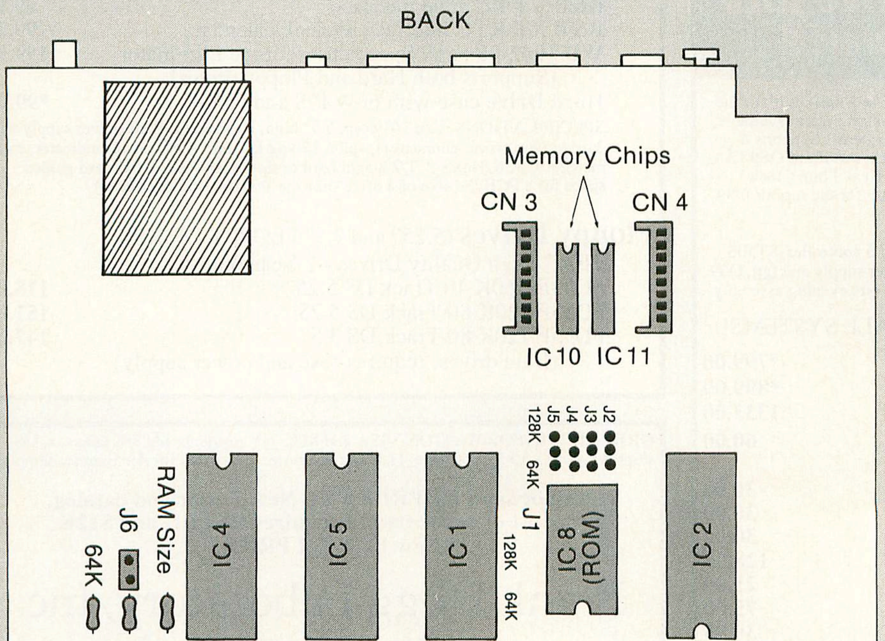


Figure 3: Front of 26-3134B, 26-3136B CoCo 2

If you want to upgrade a 26-3134A, 26-3134B, 26-3136A, or 26-3136B model CoCo 2, the procedure is slightly different. You will need two 4464 DRAM chips. These chips are 4-bit-by-64K DRAMs and have 18 pins. These are the *same* chips used in 128K CoCo 3s. If you upgraded your CoCo 3 and saved the four 18-pin chips you removed from it during that upgrade, you own two sets of "upgrade kits" for these CoCo models. When you open these CoCo 2s, you will find two socketed 18-pin memory chips — 4416 chips. Remove these two chips and replace them with two 4464 chips. Now look on the left front of the circuit board. There you will find two solder pads labeled *RAM Size* and *64K*. The two pads are enclosed by a white silk-screen rectangle. Solder a jumper between those two pads. That's all there is to it. (See Figure 3 for details.)

On all these A and B models of CoCo 2 there are two white connectors that look like the white connectors for the memory upgrade board on the CoCo 3. You cannot use those connectors. They are there to support a plug-in board with eight 4164 chips, which Tandy used at one time to upgrade these machines. When Tandy designed those boards, the cost and availability of DRAMs was in a state of flux, and Tandy could not be sure which would be the most economic upgrade — two 4464 chips or eight 4164 chips. For this reason, the company designed the boards to allow use of two 4464 chips on the board, *or* eight 4164 chips via a plug-in memory upgrade board.

The CoCo 2 B models have both the white connectors and places on the main circuit board where Tandy could solder eight 4164 chips. Therefore, the B model boards can be upgraded to 64K in one of three ways: Two 4464 chips to replace the 4416 chips, a plug-in board with eight 4164 chips, or 4164 chips soldered directly to places provided on the motherboard. For both the A and B models of the CoCo 2, I recommend using the two 4464-chip approach. This approach is cleaner, simpler, and puts less power drain on the computer.

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Testing Memory

After upgrading your memory to 64K, you should get the Color BASIC or Extended Color BASIC copyright message when you turn on your CoCo. Entering `PRINT MEM` (or `?MEM`) will give you the number 24871 if you have Extended Color BASIC or 31015 if you have Color BASIC. Even with a full 64K of memory, the CoCo is capable of using only the lower 32K of RAM under Color BASIC. This is true even for a 512K CoCo 3. The problem here is that the ROM software was never revised to work with more than 32K of RAM memory. To better test memory, try using one of a number of RAM-test programs published in past issues of RAINBOW or posted on Delphi.

ROM Upgrade

On some of the computers discussed, you may be hampered by a lack of both memory and Extended Color BASIC (ECB). With the CoCo 1 and 2, Tandy offered the machines in any of three options: 16K Color BASIC, 16K Extended BASIC and 64K Extended BASIC. Those with machines with only Color BASIC (not ECB) are missing a great deal. Such machines lack most of the graphics commands under BASIC and cannot be used with a disk controller — ECB is needed for the Disk Controller to work. If your machine does not have ECB, you can add it yourself.

There are two types of Extended BASIC upgrades for Color Computers 1 and 2. If you have only Color BASIC and own any CoCo 1 or CoCo 2 (Cat No. 26-3126 or 26-3134), you will need a 24-

There are two types of Extended BASIC upgrades for Color Computers 1 and 2. If you have only Color BASIC and own any CoCo 1 or CoCo 2 (Cat No. 26-3126 or 26-3134), you will need a 24-pin, 8K-by-8-bit Extended BASIC ROM. If you own a Cat No. 26-3134A or 26-3134B model CoCo 2, you will need a 28-pin 16K Extended Color BASIC ROM that has both Color BASIC 1.3 and Extended Color BASIC 1.1. Both these chips can be ordered from Microcom, Computer Plus, MicroWorld or Tandy National Parts. The cost should be under $25.

Installing the 28-pin Extended BASIC ROM in an A- or B-model CoCo 2 is a bit trickier. Refer to Figure 3 for a diagram of the Model B CoCo 2. Remove the 24-pin Color BASIC ROM from the 28-pin socket, and locate the five ROM size jumpers near that socket. Four are behind it, and one is to the left of the socket. These jumpers are labeled *64* on one side and *128K* on the other. They are soldered in place. The 64K and 128K refer to the number of bits in the ROM chip and are not indicative of a 128K RAM memory upgrade for that machine. Clip all five jumpers where they touch the 64K solder pad. Then bend them over so they touch the 128K solder pad. Now solder them in that position. A fine pair of diagonal cutters and a fine-tipped soldering iron are helpful. You can remove the old jumpers and install new ones; however, I prefer the first method because it's faster. After moving the jumpers, insert the 28-pin ROM chip into the socket. The notch on the chip must point toward the *front* of the computer (i.e., it should be pointing in the direction opposite to IC chips 4, 5 and 1, which lie to its left, and point in the same direction as IC 2, to its right). You have now rewired the ROM socket to accept the pin of a 28-pin 16K-by-8 ROM.

Hacker's note: The 24-pin 8K DECB ROM is pin-compatible with a Motorola 68766 EPROM. This ROM is predominantly pin-compatible with a 27128 EPROM; however, you must short Pin 1 to Pin 28 of the EPROM after programming it to make sure it will work in a CoCo. Pin 1 of the ROM is not connected internally, whereas Pin 1 of a 27128 EPROM needs to be tied high to +5 volts. On some CoCo models, Pin 1 is left unconnected. In addition, while you can read the 28-pin ROM in most EPROM programmers, you cannot read the 24-pin ROM because it is a dynamic ROM, which requires its enable line to be pulsed each time a byte is read from it. The best way to extract data from that ROM is to read its contents using a working CoCo that has the ROM installed.

Why upgrade to 512K?

All OS-9 Level II users require 512K to make any reasonable use of OS-9 Level II's capabilities. At this time, few Disk BASIC programs make use of memory above 128K. *Word Power 3.1* from Microcom, *Vterm* from Gimmesoft, and *CoCo Max 3* and *Max 10* from Colorware are among the exceptions, using a significant amount of the memory available with a 512K CoCo 3. Microcom sells a disk duplicator implementing a complete RAM image of the disk to be copied if you have a 512K CoCo 3. SpectroSystems soon presents an ADOS enhancement providing a very Disk BASIC-compatible RAM disk feature.

The Tandy 512K Upgrade

The upgrade provided by Tandy's designers is in the form of a plug-in memory board populated with 16 one-bit-by-256K (41256) chips. For this upgrade, first remove the four 4464 chips from their sockets. Next make a minor alteration in the timing of the RAS and CAS lines by removing C65 (a timing "fudge-factor" capacitor on the RAS line). Finally, insert a populated memory-upgrade board into the three white connectors provided on the CoCo 3 motherboard. Most third-party upgrades are electrically identical to the Tandy upgrade, but these vendors often suggest different timing modifications.

The 256K DRAM Crisis

About a year ago, 256K DRAMs were cheap and plentiful. They were available to dealers at about $2 a chip or less. Then U.S. chip makers — unable to compete with Japanese production — demanded limitations on memory-chip import. The government responded by pressuring Japan to cut back on this import. After this, all but one U.S. manufacturer (Micron Technologies) ceased production of 256K DRAMs, which they deemed unprofitable, and Japanese manufacturers began converting factories that had been making 256K DRAMs into plants to make 1-megabit chips. At this same time, there was an unforeseen increase in the demand for 256K DRAMs because desktop computers with standard memories of 640K or more were coming into their own. These computers required 256K chips.

The combination of these factors caused DRAM chip prices to skyrocket. Over a period of months, the price soared to a high of $15. By July '88, the price leveled off, but it hasn't come down much. Dealers still pay between $9 and $13 per chip for memory chips on a 16-chip CoCo 3 upgrade board. Therefore, the cost of a fully populated CoCo 3 memory-upgrade board can be in excess of $170. (Compare this to the $100 or so that such upgrade boards were selling for before the DRAM crisis.) There is no end to this crisis in sight. Prices for 256K DRAMs are expected to remain high for an indefinite time. No matter who is to blame for the prices, we must deal with these high memory-chip prices.

Tandy was able to lock its supply of 256K DRAMs at a fixed price for a long time, so recently the Tandy upgrade, at $130 to $150, has been the most economical way to add 512K to your CoCo

3. However, I doubt Tandy can sell memory chips at that price for long.

Memory Chips

The CoCo's manner of addressing memory is a bit odd. The timing on the GIME chip for its memory access is not quite right, especially on older (1986) GIME chips. Users have been faced with an array of inconveniences: "Sparklies" occasionally appear on the screen; memory chips in the 512K upgrade run hot; and some particular brands of memory chip work better than others for subtle reasons. I have been told that the minimum access time for proper operation of a DRAM chip on a CoCo 3 running at 2 Mhz is around 142 nanoseconds. In theory, one really should use 120-ns access-time parts. In practice, however, most 150-ns parts will work fine. Although NEC memory chips are reported to work very well, I have used several brands of memory chips (including NEC, Motorola, TI, Hitachi, Fujitsu, Micron Technologies, and Samsung) with no problems.

Available Memory Upgrade Boards

With one exception, the various CoCo 3 memory upgrade boards come with sockets for the DRAM chips and can be populated with any speed or brand of DRAM chip. With DRAMs so expensive these days, many sales of 512K upgrades are in the form of bare boards users will populate when they get good deals on memory chips.

Considerations in 512K upgrade-board design include the following:

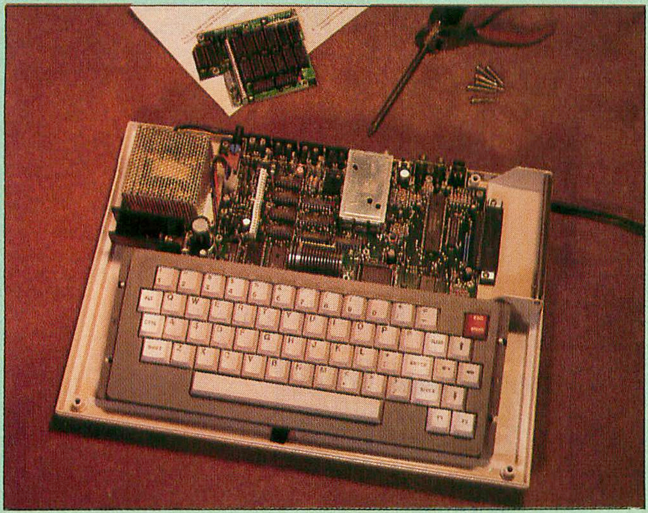
- The quality of the chip sockets used
- The layout of the traces on the board
- The number and value of deglitching capacitors used
- The positioning of the deglitching cap traces

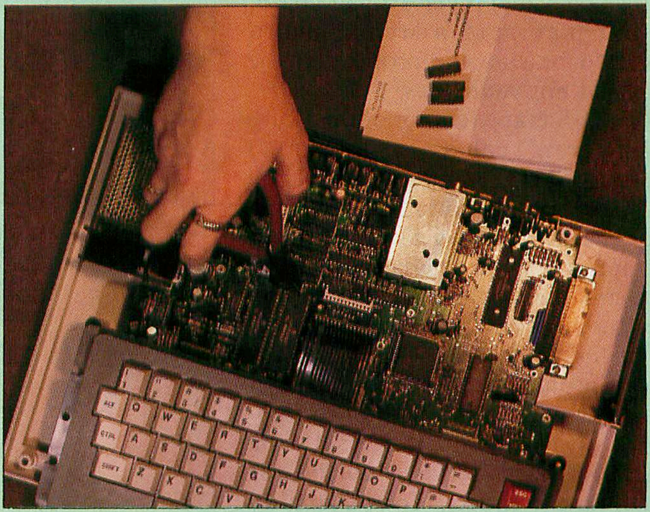
Sockets with gold plating are best but are too expensive for use in this market. Next to gold-plated sockets, double-wipe sockets would be best (i.e., sockets that contact each pin of the memory chips on two sides). Single-wipe sockets are least desirable, but they work adequately. A large fraction of CoCo 1s and 2s use single-wipe sockets for their memory chips, and the CoCo 3 uses single-wipe sockets for its 4464 chips. All these work reliably. Proper provision for wide ground plane traces will reduce noise on the power-supply lines and radio frequency interference.

In theory, every DRAM chip should have a .33-mfd deglitching capacitor wired to its positive and ground pins. In practice, many board makers cannot include a cap for every memory chip, so some chips share the same deglitching cap. In addition, many manufacturers supply boards with .1-mfd deglitching caps, despite manufacturers' specifications, which often say the .33 mfd value is preferred. The shorter the length of wire or printed circuit board trace between the power supply pins of the DRAM chip and its associated deglitching cap, the better.

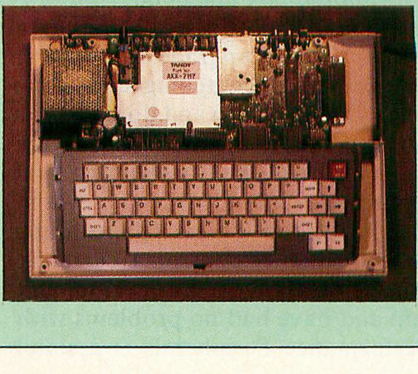
The Tandy 512K upgrade board is (or was) sold with DRAM chips by Tandy for between $130 and $150. Its price may increase as Tandy's supply of lower-priced DRAMs is exhausted. The Tandy board is unique because it is mounted upside down (i.e., the DRAM chips are facing the CoCo motherboard, and the solder side of the board is up). Tandy designed the board this way because it was easier to mass-produce. All components (including the

Tandy's 512K Upgrade





These photographs illustrate the steps involved in upgrading to 512K with the Tandy upgrade. *Above left*: The CoCo 3 with case top removed. The upgrade is shown behind the computer. *Above right*: The four 4464 RAM chips have been removed and capacitor C65 is being clipped with "dikes." While the keyboard has been left in the computer, it has been moved slightly forward. More working room can be gained by carefully removing the keyboard entirely. *Right*: The completed upgrade. Note how the ground plane is visible and the chips, which are underneath, cannot be seen.



pins that connect it to the motherboard) are soldered on the same side of the board, so the entire thing can be wave-soldered. By putting the solder side up, Tandy can add a foil-ground plane to reduce radio interference and comply with FCC regulations. Tandy has the only memory-upgrade board with such an added ground plane. Tandy's board uses roughly 12 deglitching caps for the 16 DRAM chips, and each are .1-mfd in value. All reports indicate that the Tandy board works adequately; however, when the DRAM chips get hot, their position beneath the board conserves that heat. Tandy uses single-wipe sockets in all of the Tandy 512K upgrade boards I have seen.

Although PBJ no longer makes products for the CoCo market, before it disappeared it ran off a large number of 512K memory-upgrade boards. This board is still sold by Computer Plus. The board comes with about a dozen .1-mfd deglitcher caps for its 16 memory chips. It is supplied with a variety of sockets — sometimes double-wipe, sometimes single-wipe. I used a PBJ upgrade board for nearly a year in one of my CoCo 3s, and it worked fine. One word of warning: PBJ's quality control seems a bit sloppy. I have seen three separate boards delivered to customers "dead on arrival." Naturally, a dealer will take back and replace a bad board, but you may need a second board present to be sure the problem is the board and not your chips.

Tony DiStefano (author of the "Turn of the Screw" column in RAINBOW) designed a 512K upgrade board sold by CRC. This is the smallest 512K upgrade board I have seen. Tony also uses .1-mfd caps. He says some production runs of the board use single-wipe sockets and others use double-wipe sockets. I used one of his boards for several months with no problems, nor have I heard of any problems with them. Prior to shipment of any bare board, it is tested using continuity checks to weed out boards with internal shorts. Tony's quality control should be quite good.

Performance Peripherals makes a high-quality 512K upgrade board using sixteen .33-mfd deglitching caps (one for each DRAM chip) and double-wipe IC sockets. Bare upgrade boards are tested in a CoCo 3 before shipping, and the boards are sent only when tested and burned in as good. This is a painstaking amount of quality control. I currently use one of its boards in my development system and have had no problems with it. Performance Peripherals is a small company but worthy of serious consideration by CoCo 3 owners.

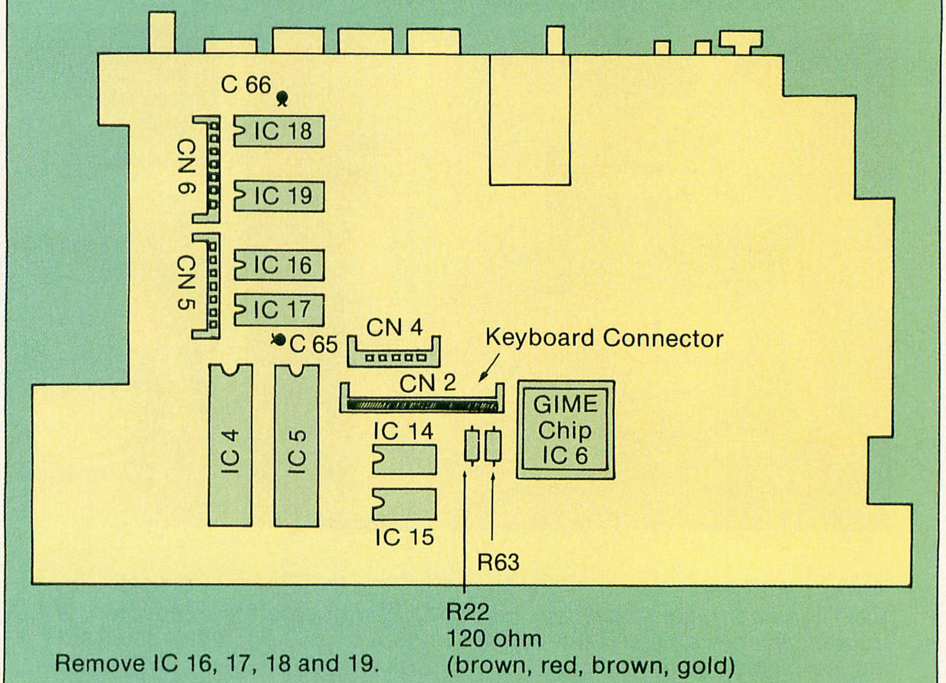
J&R makes another design of memory upgrade board. This board features an excellent ground plane on the PC board. The company uses double-wipe sockets and 16 caps (one per DRAM chip); however, it tends to use only .1-mfd instead of .33-mfd caps. I've never used this board, but I have examined one. It looks well-made and -designed, and I have heard of no problems from anyone using one. J&R is the only company to offer a board in kit form (without sockets on the board).

The Hemphill upgrade is the most unique memory upgrade of all. Instead of using dual-inline pin chips, Hemphill uses single-inline pin chips. This lets the company make a very small circuit board and include one capacitor per chip. The company uses .33-mfd caps. The memory chips are soldered to the board, making them less usable anywhere else but making the board reliable and trouble-free. Hemphill's upgrade has a reputation as one of the most reliable and trouble-free 512K upgrades. You must buy this board with the chips provided.

All 512K upgrade boards advertised in RAINBOW work fairly well. Although there are a number of theoretical reasons to prefer one to another, you will get reliable performance regardless of which one you purchase. (See Table 1.)

Timing Modifications

When you install a 512K upgrade board, make a timing modification to the computer, or it will not work. There are various modifications to the CoCo 3 recommended by different manufacturers. Tandy's service manual for the CoCo 3 specifies the removal of only C65 (the RAS timing fudge-factor capacitor). Many third-party upgrades specify removing both C65 and C66 (a CAS line timing fudge-factor cap). Hemphill Electronics suggests yet a third timing modification for installation of its upgrade. The company suggests leaving both C65 and C66 in place and soldering a 47-ohm resistor in parallel with R22 (a 120-ohm timing fudge-factor resistor on the RAS line). Some people who have tried the Hemphill modification say their memory chips run cooler with that modification than with the cap-removal mods. Some



Remove IC 16, 17, 18 and 19.

512K upgrade board plugs into connectors CN4, CN5 and CN6

Figure 4: 512K CoCo 3 Upgrade

also claim the Hemphill method results in fewer or no sparklies on machines that previously had them.

Figure 4 shows the location of the various components referred to above. C65 and 66 are little green blobs, and R22 is a gray cylinder with brown, red, brown and gold stripes. If you destroy the capacitors in the act of removing them, you can find near replacements at Radio Shack. Radio Shack Part No. 272-121 is a 47-pf capacitor. Two of those in parallel will be 94-pf — close to the 82-pf value for C65. Two of those capacitors in series will yield a value of 23.5 pf — close enough to the 27-pf value for C66. If you try the Hemphill upgrade, Radio Shack sells a 47-ohm resistor (Cat. No. 271-009).

Company	Product	Warranty	Bundled Software	Comments
Tandy/Radio Shack*	Tandy 512K	90-Day	None	Optional installation extra.
Computer Plus*	Tandy 512K Tandy 0K PBJ 512K PBJ 0K	90-Day One Year	None	Optional installation extra.
The Computer Center*	Disto 512K	90-Day	RAM Disk RAM Test	Optional installation extra.
Owl-Ware*	LR Tech 512K Performance Peripherals 512K	One Year One Year	RAM Disk RAM Test Printer spooler	Optional installation extra.
Performance Peripherals	Performance Peripherals 512K	One Year	RAM Disk RAM Test Printer spooler	
MicroWorld*	Tandy 512K	90-Day	None	Optional installation extra.
Microcom Software*	Performance Peripherals 512K	90-Day	RAM Disk RAM Test Printer spooler Backup utility OS-9 LII RAM Disk	Optional installation extra.
CRC/Disto	Disto 512K	90-Day	RAM Disk RAM Test Printer Spooler	Optional installation extra.
Arizona Small Computer Co.	Disto 512K	180-Day	RAM Disk RAM Test Printer Spooler	In-shop installation included.
J & R Electronics	J & R 512K J & R 0K J & R Kit		RAM Disk RAM Test Printer Spooler	Available in kit form.

*These advertisers also offer 64K upgrades for the CoCo 1 and 2.

Because of rapidly fluctuating chip costs, our advertisers request that you contact them for current pricing information.

Table 1: Sources for CoCo Memory Upgrades

About Those 4464 Chips...

Memory on the CoCo 3 is addressed via the GIME chip, which is both a memory-manager chip and a video-display generator chip. The CoCo 3 comes supplied with 128K of memory in the form of four socketted 4-bit-by-64K 18-pin 4464 chips. This memory is wired so it presents 64K of 16-bit words to the GIME chip. Therefore, while the 6809 can address external memory along an 8-bit data path, the GIME chip can read the DRAMs 16 bits at a time. This allows the GIME chip to read memory faster to properly update the Hi-Res color graphics screens. Each of the four 64K-by-4 chips contributes one quarter of each 16-bit word read by the GIME chip.

The logical way to accomplish an upgrade to 512K on the CoCo 3 would be to substitute 4-bit-by-256K chips for the 4-bit-by-64K chips with which it came. After all, 44256 chips do exist; they sell for about $45 each. But Tandy chose not to provide for this upgrade route. The 44256 chips are 20-pin chips, with a different pin out from the 4464 chip. Worse, the 44256 chips require a different refresh cycle because they are internally more like the 1-bit-by-1-megabit chips than the 4-bit-by-64K chips. They require a 512-cycle refresh while the GIME chip provides a 256-cycle refresh. There is no way around this problem. The chips cannot be interfaced to the GIME chip.

Finally, hold onto those 4464 DRAMs you remove. If a problem develops in your upgrade, you will have an alternative of downgrading to 128K, or you may want to switch these chips with those in another board. There are not many machines around that use the 4464 DRAMs for memory upgrade, except the Tandy 3000 and some 10-Mhz 8088 PC compatibles. If you are certain you have no use for your 4464 DRAMs, you can send them to me in care of RAINBOW magazine. I sometimes have projects that use them.

That's all there is to it. Follow the instructions found in this article carefully, and you will soon have the memory you and your computer need. Modifying your Color Computer takes time and patience. Look around; find the best merchandise for you. Then watch for the best prices on that equipment. Once you have your parts and your tools, be sure to take the time to do the work right.

PREMIUM COCO3 512K UPGRADE
•Made in USA by J&R Electronics •Memory chips socketed, user replaceable
•Rugged, long life construction •Top mounted Memory for cooling
•Heavy duty POWER and GROUND planes to minimize memory errors due to noise
•High performance design, permits use of less expensive 150ns memory chips
•We supply Prime memory chips, not inferior pulls or fallouts*
•Includes RAMDISK, Spooler and Memory Test software on disk with 28 page User's Manual (We set the standard for 512K support software. We believe our software is uniquely powerful, as opposed to those 'Me, too' companies that charge extra for software with much less power!)
SPECIAL PRICES
#1010-29.95 JramR bare board plus connectors and software
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The Dazzling Word Processor and Document Creator for the CoCo 3.
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What's the best choice? You decide

A Hard Drive for Your CoCo

By Martin H. Goodman, M.D.

Over the last two years, more and more Color Computer owners have been adding hard drives to their systems and enjoying the benefits of greater storage capacity and speed of operation. During this time, vendors have begun to market a variety of hard-drive systems, and the entry-level price for these has dropped under $200 — even for the non-hacker. When you compare the cost of adding a hard drive to that of adding two floppy drives to your system, you'll see that the hard drive is the sensible choice. For around $250, you can add a 5- or 10-Meg system and increase storage and access speed.

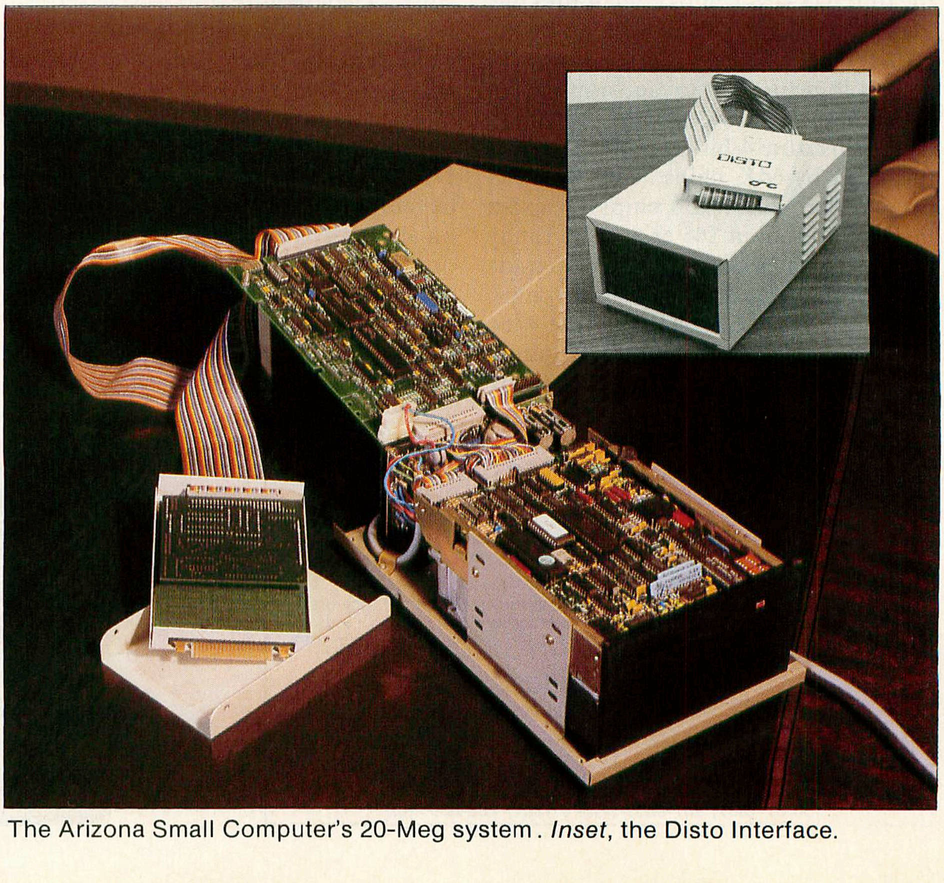
When you consider adding a hard drive, you are bombarded by a bewildering array of alternatives. This is an introduction to the basic elements of any CoCo hard-drive system and the options available for it. I don't have experience using all the systems described, so do not consider this a comparative review of the products.

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

The Elements of a CoCo Hard Drive

Color Computer hard-disk systems consist of both the physical hardware (circuit boards, hard drive, case and power supply) that must be added to the system and the driver software that lets the system use this added hardware. The differences in OS-9 driver software are of limited significance; however, the differences in Disk Extended Color BASIC driver software are significant.

A final common element in all hard-drive systems is the actual hard drive. Hard-disk drives are characterized in terms of their physical size, the number of platters inside them, the number of



The Arizona Small Computer's 20-Meg system. *Inset*, the Disto Interface.

cylinders per platter and the number of heads. A *platter* is the hard disk inside the drive. Typically, each platter is serviced by two heads, one on each side of the platter. These heads write concentric circular tracks of data called *cylinders*. A CoCo floppy disk will have a maximum of two heads, each of which accesses up to 40 tracks, for a total data-storage capacity of 360K bytes. A small data capacity hard-disk drive will have four heads and 306 cylinders (tracks) for each head — a total capacity of 10 Meg. Higher-capacity drives can have over a thousand cylinders per platter and eight or more heads — and up to 500-Meg capacity.

The disk in a CoCo floppy drive rotates at 300 rpm. The disks in a hard drive rotate at 3600 rpm. The heads of the hard drive float a fraction of an inch above the oxide-coated aluminum platters, which are physical disks inside the hard disk drive. Do not jostle the hard-disk drive or the case in which it resides while it is in operation. A minor bump while the drive is spinning can cause the head to bash into the platter, destroying all the data on that cylinder and (perhaps) adjacent cylinders as well. In addition, this can destroy the heads, rendering the drive useless and destroying all the data on it.

Hard drives used in CoCo systems are manufactured by many companies and come in an assortment of sizes, shapes, capacities and power requirements. They can be as big as 5¼-inch, full-height floppy drives or as small as 3½-inch half-height drives. Hard drives vary in capacity from 5 to several hundred Meg. Those commonly used in the Color Computer market are in the 5- to 40-Meg range. When we discuss small-capacity (5- to 40-Meg) hard-disk drives, the bigger drives are older drives.

Most hard-drive systems for the CoCo use a hard drive with a logic board, which talks to the hard-drive controller via a ST506 or ST412 interface. This interface consists of a 34- and a 20-contact edge connector. It is named after two ancient 5-Meg Shugart drives: the ST506 drive and the ST412 drive, which originally used this hardware interface. This same generic physical hard drive is still used in most IBM PC XT and AT-compatible computer systems. The phrases *ST506* and *ST412* refer to the same physical hardware.

However, the old ST506 drive from Shugart did not include buffered seeks. This deficiency resulted in slower operation. For years, all hard drives with ST506/ST412 interfaces have been made with *smart* logic boards, and to varying degrees, they support buffered seeks. Although the term *ST506* implies a drive that does not support buffered seeks and the correct term is *ST412*, in practice the two terms are used interchangeably.

In most cases, the hard drive and a power supply will be mounted in a case, often with an additional *controller* circuit board. While hard drives resemble floppy drives externally, they usually require more power. Thus, only the latest (most expensive and compact) 3½-inch hard drives can use a power supply designed for floppy drives. In order to reach the appropriate speed, the oldest full-height hard drives require as much as 5 amps on their 12-volt supply lines during the first seconds of operation. Once at operating speed, such drives draw 1 to 2 amps at 12 volts and about an amp at 5 volts. By comparison, a typical floppy drive requires 0.6 amps at 12 volts and 0.3 amps at 5 volts.

One major difference between the various hard drives is the distinction between those that can and those that cannot be used with an RLL (Run Length Limited) controller. Most hard drives are designed to work with hard-drive controllers that write data to the platters with MFM (Modified Fre-

What Does a Hard Drive Offer?

A 20-Meg hard-disk drive holds more information than 120 single-sided, 35-track floppy disks or about as much information as 55 double-sided, 40-track floppy disks. Information on the hard drive can be accessed more than ten times as fast as information on a floppy drive. With a hard drive, you don't need to shuffle through stacks of disks looking for the program or file you need; it's at your fingertips.

Hard drives do not completely replace floppy drives. Many systems still require at least one working floppy drive, which is accessed when the system is booted. Hard-drive users will need to use floppy disks to add new software and data to their systems and to back up the information on their hard drives. The latter is critical, for in the unlikely event that your hard drive crashes, greater amounts of data can be lost than with floppy drives.

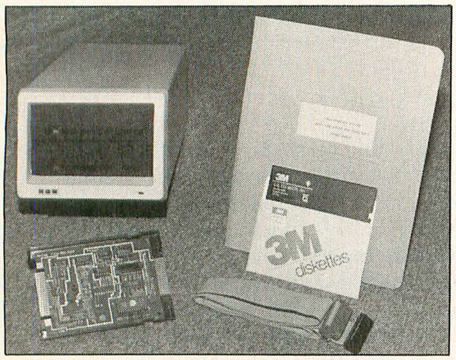
All OS-9 Level II users will benefit from a hard-drive system. OS-9 can be cumbersome on a floppy-based system if all your most-used commands aren't loaded into memory at startup. A seasoned OS-9 user will still benefit from having all software and data files on hand. In a hard-drive system, OS-9 Level II comes into its own. Because of OS-9's design, software compatibility with any OS9-based hard-drive system is near 100 percent. There are some exceptions (including hard-coded drivers found in some sloppily coded Tandy OS-9 games). However, these are the exceptions, and patches can be made for most of them.

Many Disk Extended Color BASIC (DECB) users will benefit from a hard-drive system; however, here the issue is not as clear-cut as it is for OS-9 users. Most DECB applications run fine on a floppy-disk system. However, the system code in the BASIC ROM was designed for use with 35-track, single-sided floppy drives and was not written to substitute larger-capacity floppy drives or hard-disk drives easily. Because the system code in the ROM is so inflexible, authors of different DECB software chose a variety of ways to let their programs handle disk files. Some of the methods make it hard for the application program to work with the modified DECB code needed for hard-drive systems. Because neither Tandy nor Microsoft set standards for extending DECB to larger floppy- and hard-drive capability, authors for different hard-drive systems chose various approaches to such extensions. However, in some cases, the DECB software patches sold by one company are available in versions that run with hardware sold by different companies.

DECB users who brave the problems associated with running Extended Color BASIC on a hard drive will benefit from the immense storage provided by this system. While compatibility problems are real, the popular implementations of DECB hard-drive systems have solved most of them, and patches make the more popular application software hard-drive compatible. Those who use DECB software to generate and modify graphics images will benefit from use of a hard drive. Such users work with many moderate-sized picture files and will appreciate not changing disks constantly to find or save the necessary graphics file. DECB-based BBSs are improved by the addition of a hard-disk drive because the operators can maintain a larger message and database area than with a floppy-drive system. ☐

quency Modulation) coding. Some of the newer hard drives also accept data sent in RLL format. These RLL-capable drives hold about 50 percent more data when used with an RLL controller rather than an MFM controller. The speed of data transmission between the drive and the controller is also 50 percent faster when used with an RLL controller.

While one might assume that RLL is the way to go, only a fraction of the newer (more expensive) hard drives can be used with an RLL controller, and some disk drives rated for use with RLL don't give reliable operation when used in that manner. The Seagate ST238 drive is an example of a drive rated for use with RLL but only able to give reliable performance when used with an MFM controller. The "extra speed" RLL offers is of little significance on CoCo systems because the speed bottleneck is not between the drive and the controller board but between the CoCo's host adapter and the controller board. Finally, few CoCo users need to squeeze the extra megabytes out of the hard drive. Unless you know what you're doing and really need every byte you can get, stick to the reliable (less expensive) MFM hard drives and controllers.



A complete system from RGB.

The Controller Board

In order to hook a CoCo to a floppy drive, you need to plug a floppy-drive controller card into the CoCo or Multi-Pak Interface. This card is designed for the Color Computer and connects to the CoCo system bus at one end and to the logic board's 34-pin edge connector on the floppy drive. All hard-drive systems for the CoCo also require a controller board. Like the floppy drive's controller board, this board connects (via two cables) to the logic board on an ST506 interface hard drive. Unlike in the floppy system, however, this card does not plug into the Color Computer or Multi-Pak.

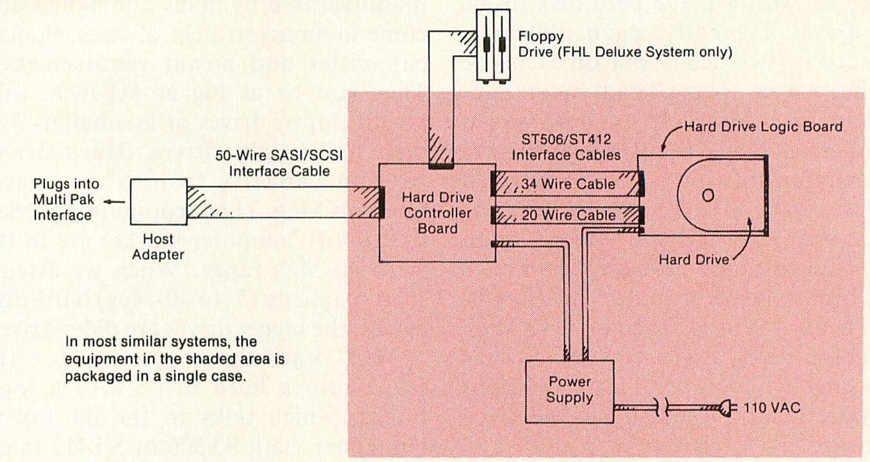


Figure 1: Typical hardware setup.

None of the controller boards used with CoCo hard drives were designed for the Color Computer. They are generic hard-drive controller boards used on a large number of small computer systems. In almost all cases, these boards talk to the main computer system via a SASI or SCSI bus, which usually takes the form of a 50-pin cable. The main computer system must have another card plugged into it to generate the bus. This other card is usually referred to as the *host adapter.*

SASI (pronounced *sassy*) stands for Shugart Associates System Interface. It represented the earliest incarnation of the bus now used to hook small computers to hard-drive controllers. The SASI protocol is a hardware and software standard because it defines the cable, the nature of the signals carried and details of the software protocol used. In this manner, the computer can talk to devices on the SASI bus. Electronically this standard is a parallel port, allowing 8-bit data transfer between a small computer and other devices (such as a hard-drive controller card). Originally this bus took the form of a 50-wire cable. However, many of the wires on that cable were reserved for future assignment, and uses were never defined for them, so some CoCo hard-drive systems use less than 50 wires in the SASI cable.

Soon after the SASI standard was introduced by Shugart, others decided to make some improvements. SASI was enhanced and incarnated as the SCSI (Small Computer System Interface) standard. SCSI (pronounced *scuzzy*) is backward-compatible to SASI (i.e., a computer generating a SCSI bus can talk to a device that has a SASI bus). A computer that generates a SASI bus *may* be able to talk to a device with a SCSI bus, but it cannot use all the SCSI standard features.

SASI and SCSI differ significantly because the SCSI bus supports multiple-master devices on the same bus (i.e., there can be more than one controlling host computer on the same SCSI bus). This is implemented through use of open-collector control lines and other hardware and software protocols. Additionally, full SCSI ports allow the hosts to be disconnected and reconnected in the middle of a command sequence.

Both SASI and SCSI ports can support multiple slave devices, and frequently both standards are used together. Indeed, you often encounter the phrase *SASI/SCSI compatible.* With either SASI or SCSI ports, a hard-drive controller card can be supported, and tape backup and CD ROM units can (in theory) be added. True, this ability is almost useless to most Color Computer users because no standard packages include hardware and software for using such devices. However, such packages may be available in the future, so the manufacturers of CoCo host adapters have been revising their products to make them SCSI-compatible and to increase the number of devices on which they can work.

Hard-drive controller cards differ from CoCo floppy-drive controller cards in another respect: They are smart devices with onboard microprocessors. At a software level, the host computer talks to these boards using a sophisticated language. A single command can tell these boards to fetch a sector from the hard drive or to write one. These boards usually *buffer* (store on the board) at least a sector's worth of data. Thus, the CoCo can send data to the hard-drive controller board and then do other things while the hard-drive controller board writes that data. Similarly, the CoCo can tell a hard-drive controller board to fetch a sector and then do something else while the board finds that sector on the hard drive, takes the data from the hard drive and places it in its buffer. When the board has gathered the requested data, it will send the CoCo an interrupt to let the computer know it has the data. In contrast, standard CoCo floppy-drive controllers are simple (dumb) devices. You must write tedious, critical code to walk these controllers through their operations.

The Host Adapter

The host adapter is a card specific to the CoCo system bus into which it plugs. On the host-adapter card, some circuitry creates a SASI or SCSI bus. This bus then links the host adapter (and thus the CoCo itself) to the generic hard-drive controller board. Most host adapters for the CoCo exchange one byte of data between the CoCo and the SASI or SCSI bus at one time.

A typical CoCo hard disk system is shown in Figure 1. This figure is a representation of the arrangement of hardware used in Owl-Ware/LR Technologies, RGB Computer Systems/Ken-Tron Electronics, and Isted/Frank Hogg Laboratories. In these setups, a separate physical host adapter plugs into the Multi-Pak. This adapter produces a SASI or SCSI bus connected via ribbon cable to a separate box housing a hard-drive controller, the actual hard-disk drive with its logic board, and a power supply to operate the hard-drive and the hard-drive controller board. Please note: Although the Isted/FHL Deluxe system's host adapter uses the same interfaces as the other systems mentioned in Figure 1, this adapter uses a bus unique to that system.

Although many hard drives talk to the rest of the computer system (specifically to a hard-drive controller) via a ST506 or ST412 interface, more recently manufacturers have been making hard-disk drives that are attached to a combined logic and controller board. Such hard drives connect to the rest of the system via a SCSI bus because it eliminates one extra board (the SCSI controller board). By eliminating the ST506 interface, faster data transfer rates can be achieved. Apple Macintosh and Macintosh II computers use such SCSI drives, as do some high-performance IBM PC systems. Drives equipped with the SCSI board tend to be higher-capacity drives. I know of no dealer who currently supplies such drives with any of the commercial packages, but hackers who chance upon such drives should know that when hooked to a CoCo SASI/SCSI host adapter they can operate with the CoCo. Check with the maker of the software and host adapter to see if a particular SCSI drive is supported. The Shugart N series works with most current CoCo host adapters (i.e., those from CRC/Disto, Owl-Ware, Frank Hogg Laboratories and Ken-Ton Electronics/RGB Computer Systems.)

The Hard-Drive Market

Radio Shack is not in the CoCo hard-drive market. The Tandy Color Computer's hard-drive host adapter

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(the only one supported by the hard-drive *software in* Tandy's OS-9 package) has three small-scale logic chips and a 50-pin connector. Tandy sells this device for $129.95, without a hard-disk drive or a controller. Old Radio Shack 35- and 15-Meg hard-drive packages have an internal customized WD-1000 controller. It works properly only with a few specific Tandy hard-drive packages, which are no longer sold. This takes Tandy and Radio Shack out of the CoCo hard-drive market.

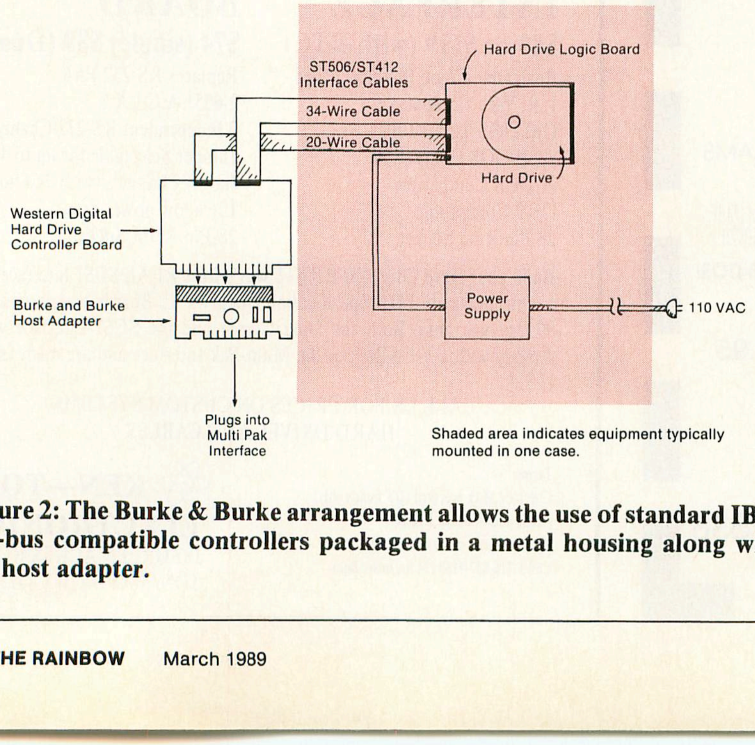
Burke & Burke

Figure 2 illustrates a significant variant of the basic component arrangement. Chris Burke, of Burke & Burke, wanted to design a low-cost, quality hard-drive system for the CoCo. He noted that one of the major expenses in most CoCo systems was the controller card. These generic SASI or SCSI cards cost $150 or more brand new. Although suppliers could sometimes get deals on used controller boards, such supplies were uncertain and could falter at any time. Chris says he got an idea from one of my "CoCo Consultation" columns about the desirability of adapting devices specific to the IBM PC world to the CoCo and so benefiting from the economy of mass production enjoyed by such products. Chris noted that IBM PC-specific hard-drive controller cards were often available for $50 or less new. These PC-specific products were a combination of an IBM host adapter and the controller card — all on the same card. Chris decided to adapt a particular IBM bus-specific hard drive controller card to the CoCo.

Much to his (and everyone else's) surprise, the hardware needed to make this conversion of the Western Digital IBM disk controllers was simple. To make the conversion, he used a single inexpensive chip. Indeed, most of the magic (and expense) of his adapter is in the box that supports the PC Western Digital hard-drive controller card and converts it — electronically and physically — into a device that plugs into a Multi-Pak. Chris even had room on his adapter to provide an optional real-time clock.

Having adapted the hardware, Chris was faced with the problem of writing drive software. IBM PC disk controllers all write 512-byte sectors, but CoCo Disk BASIC and OS-9 operating systems are geared for 256-byte sectors. Using clever software tricks, Chris solved those problems and now offers a full line of hardware and software for his system. Indeed, his *Hyper I/O* (for running DECB on the hard drive) became so popular he developed versions of the software that are compatible with other brands of CoCo hard-drive hardware, including those from CRC/Disto and Owl-Ware.

The system developed by Chris Burke of Burke & Burke is different from all the other systems available for the Color Computer. All other systems use a generic SASI, SCSI or similar controller and come with a host adapter to let the CoCo generate the signals needed for the controller board to talk to the computer. The Burke & Burke system uses a different sort of hard-drive controller.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20-Wire Cable
Hard Drive
Western Digital Hard Drive Controller Board
Burke and Burke Host Adapter
Power Supply
110 VAC
Plugs into Multi Pak Interface

Shaded area indicates equipment typically mounted in one case.

Figure 2: The Burke & Burke arrangement allows the use of standard IBM PC-bus compatible controllers packaged in a metal housing along with the host adapter.

Hard-drive controller cards designed to work with the IBM PC-compatible computers are different from the generic SASI and SCSI controllers. They are designed to plug into the system bus on an IBM PC. A host adapter dedicated to PC-compatible computer buses and a hard-drive controller are on the card. Due to the economics of mass production, these cards are available (new) for between half and a quarter of the price of comparable SASI and SCSI cards.

Chris Burke decided to use the Western Digital line of PC-compatible controller cards. Later he was able to support a few other common IBM PC controller cards. (A full listing of these is given in the hardware section of this article.) Chris Burke devised an adapter and cage, so the PC-bus Western Digital controller card can be adapted to the CoCo system bus and mounted in a little metal box. This device connects to the logic board on the physical hard drive via the standard ST506/ST412 cables (one 20-pin cable and one 34-pin cable).

This arrangement has a number of advantages. First, if you own this system and later want to convert to a PC-compatible computer, you already have a hard drive and controller card for it in the Burke & Burke system. Next, the Western Digital hard-drive controllers are widely available, and hackers who want to build their own system are able to purchase just the adapter and necessary driver software from Burke & Burke.

However, there is a far greater advantage to Chris Burke's choice of controller. Using these PC controllers, he is able to transfer data between them without time-consuming hardware/software handshaking. Thus, his system has data-transfer speeds similar to that exhibited by the FHL deluxe system. Indeed, in some independent tests reported by Kevin Darling, the Burke & Burke and FHL systems both took about 45 seconds to transfer a megabyte of data from a hard drive while the various SASI/SCSI-based CoCo hard drive systems took 85 seconds.

Chris Burke also makes available the adapter board only. Chris not only provides needed device descriptors and drivers for his hard-drive systems, he also sells a useful utility called *EZGen*, which makes altering your boot file a simpler process than it used to be. Burke & Burke employs the ROM socket on the Western Digital controller card to provide data for booting the system from the hard drive. However, Burke &

Burke will not provide source code for their drivers. The company supports Radio Shack's Disk Extended Color BASIC on its hard-drive system through a product called *Hyper I/O* — a powerful (somewhat complex) software package that allows you to create virtual disks of any size to run under Disk BASIC. You can use *Hyper I/O* to create both 35-track virtual drives and giant virtual drives on the hard drive. It can also be used with a normal floppy disk controller to utilize 40- and 80-track double-sided disks. The level of compatibility with *Hyper I/O* is quite good. Even most programs that use undocumented ROM calls will work with it. Versions of *Hyper I/O* that work with Owl-Ware, Disto and RGB systems are available. Unfortunately, RGB Computer Systems' Disk BASIC for hard-drive systems is not available in a version that works with Burke & Burke's hardware.

Burke & Burke encourages hidebound Disk BASIC programmers to try OS-9 with yet another product it sells. *RSB* is an OS-9 program that lets you run DECB under OS-9. It provides a familiar programming environment for Color BASIC users within the OS-9 operating system, while providing access to some of OS-9's unique aspects. (See Page 110 for a more detailed review of *RSB*.)

BURKE & BURKE
CoCoXT / CoCoXT-RTC
Hard Disk Interface
Universal Installation Handbook
Seagate

Burke & Burke's 20-Meg system (ST-225), packaged and sold by Howard Medical.

At present, Burke & Burke does not sell its hardware as packaged systems. The company's hard-drive hardware and software is used, however, in fully configured hard-drive systems available from a number of respected CoCo vendors. Howard Medical in Chicago and Microcom and Frank Hogg Laboratories in New York sell systems using the Burke & Burke line of products. These companies sell new, tested 20-Meg Seagate ST225 half-height 5¼-inch hard drives with the systems they sell. All three companies have long track records as honest dealers in the CoCo Community. These three companies have enjoyed many compliments from their customers for their prompt service and equitable resolutions of any problems arising in the course of sales. I know and recommend the people at all three companies.

Steve Bjork currently uses a Burke & Burke hard-drive system and reports

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- Along with your entry, send a cover letter with your name, address and phone number, detailing how you created your picture (what programs you used, etc.). Please include a few facts about yourself, too!
- Your name, address and phone number, along with the title of your work, must be clearly marked on the back of each entry, and a disk copy of each piece must also be included.
- Entries must be mailed to THE RAINBOW before March 31, 1989, or brought to the RAINBOWfest registration booth by 10 a.m., Saturday, April 15th.
- All entries to CoCo Gallery Live become the property of Falsoft, Inc., all rights are reserved.

There will be two categories: one for graphics produced on the CoCo 1 and 2, and one for CoCo 3 graphics. Several awards will be made in each category. Winners will be determined by votes from RAINBOWfest attendees. In case of any ties, winners will be determined by our chief judge, CoCo Cat.

Prizes and ribbons will be presented Sunday, April 16, 1989, and winning entries will be published in the August '89 issue of THE RAINBOW. Send your entry to "CoCo Gallery Live," THE RAINBOW, 9509 U.S. Highway 42, Prospect, KY 40059.

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Many people who write for THE RAINBOW — as well as those who are written about — are there to meet you and answer questions. You'll also meet lots of other people who share your interest in the Color Computer. It's a person-to-person event and a tremendous learning experience in a fun and relaxed atmosphere.

A special feature of RAINBOWfest is the **CoCo Gallery Live Showcase,** where CoCo artists enter their own graphics creations for display at the show. Cash prizes are presented and winning entries are decided by votes from RAINBOWfest attendees. *(See the previous page for more* details.) As an additional treat for CoCo Kids of all ages, we've invited frisky feline CoCo Cat to join us for the show. RAINBOWfest has something for everyone in the family!

If you missed the fun at our last RAINBOWfest in Princeton, why don't you make plans now to join us in Chicago? For members of the family who don't share your affinity for CoCo, there are many other attractions in the Chicago area.

The Hyatt Regency Woodfield — Schaumburg, Illinois offers special rates for RAINBOWfest. **The show opens Friday evening** with a session from 7 p.m. to 10 p.m. It's a daytime show Saturday — the CoCo Community Breakfast (separate tickets required) is at 8 a.m., then the exhibit hall opens promptly at 10 a.m. and runs until 6 p.m. On Sunday, the exhibit hall opens at 11 a.m. and closes at 3 p.m.

Tickets for RAINBOWfest may be obtained directly from THE RAINBOW. We'll also send you a reservation form so you can get a special room rate.

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Rick Adams — Software Developer

Our keynote speaker for the traditional CoCo Community Breakfast is Rick Adams, who is the founder of Color Central Software and the author of programs like *DELPHIterm*, Tandy's *Temple of ROM* and Activision's CoCo 3 version of *Shanghai*.

Mr. Adams will describe his life as a programmer on the "front lines" of the ongoing efforts to program software for the CoCo 3, including humorous "war stories" from some of his software developments.

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that it has fully met his need for a reliable system for software development. In addition, Tim Koonce (author of *Vterm*) has praised the Burke & Burke system, which he uses daily. Both of these CoCo celebrities have only the highest praise for the extensive support Chris Burke has offered when support was needed.

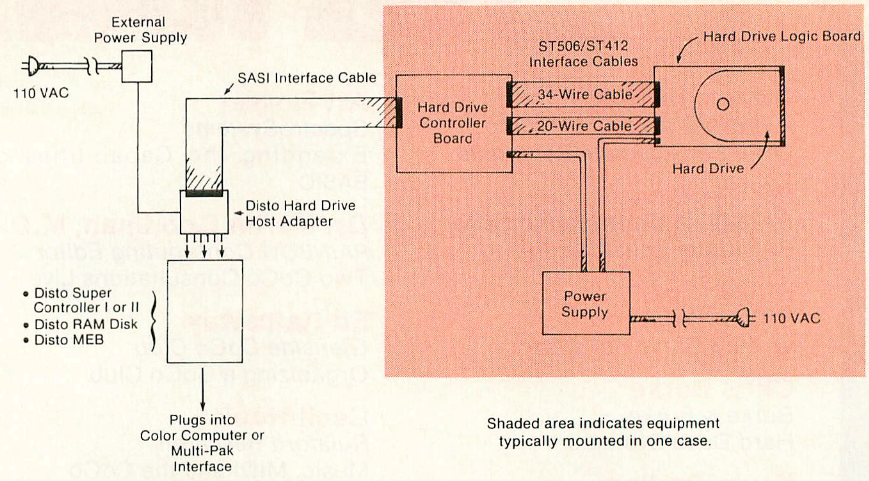
CRC/Disto

Figure 3 shows another variant of the typical arrangement. Tony DiStefano has been designing an extensive line of products for the CoCo to eliminate the need for a Multi-Pak. His hard-drive host adapter does not plug into the Multi-Pak. Instead, it is on a card with an MEB (Mini-Expansion Bus, specific to CRC/Disto products) that mounts inside one of the two available CRC/Disto floppy-disk controller cards. Thus, you can hook a floppy-disk controller (regular or no-halt variety) and a hard-disk drive to your CoCo without using a Multi-Pak. However, you must use the CRC/Disto controller in order to do this, and you cannot add another company's hardware cards to your system without getting a Multi-Pak. CRC/Disto is selling a 4-in-1 MEB card that has a hardware serial port, parallel port, real-time clock and a Disto host adapter on a card that fits inside a CRC/Disto floppy controller. If you choose the 4-in-1 card, you will need to supply an external power source (using a wall transformer) because the CoCo 3 does not have enough power to operate both the floppy controller and all four other functions.

Tony DiStefano (author of RAINBOW's monthly "Turn of the Screw" column) is the engineer behind the line of Disto products produced and sold by CRC of Canada. Even before it had a hard-drive host adapter, Disto had standardized its line of products around a unique Mini-Expansion Bus (MEB).

The MEB was created to eliminate the need for a Multi-Pak. This is nice because the Multi-Pak is no longer being produced. Currently, CRC/Disto has four products that create the MEB. Among them are the Super Controller I and the No-Halt Super Controller II. These controllers can work as ordinary floppy-disk controllers, but they are internally expandable because they possess this mini-expansion bus. (The Super Controller II is available from Radio Shack stores through Express Order.)

CRC/Disto makes two cards that act as SASI/SCSI hard-drive host adapters. Both are tiny cards that plug into the MEB inside either of the Super Controllers. One card is only a host adapter. The other is a 4-in-1 card that offers a serial port, a parallel port, a real-time clock, and a host adapter. The 4-in-1 card requires a separate power supply, because the CoCo 3 alone cannot supply enough current to operate all of its functions. Either of these host-adapter cards then connects to SASI or SCSI hard drive controller boards, which in turn connect to a ST506/ST412 interface hard drives. (See Figure 3.)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Hard Drive
Disto Hard Drive Host Adapter
• Disto Super Controller I or II
• Disto RAM Disk
• Disto MEB
Power Supply
110 VAC
Plugs into Color Computer or Multi-Pak Interface

Shaded area indicates equipment typically mounted in one case.

Figure 3: The Disto interface is plugged into an expansion point offered on many other Disto products.

If you already have a Multi-Pak or other disk controller, Disto offers one of two alternatives. You can purchase an MEB Card, which adapts Disto's two host-adapter cards so they can be plugged into a Multi-Pak. You can also purchase the RAM disk card, which supports up to a megabyte of extra RAM (that can be used only as a RAM-disk, not as main system memory). This provides space to plug in MEB-based host adapters. If you use either of these adapter cards, you can use Disto host adapters with other brands of regular and no-halt disk controllers.

Disk BASIC users will be happy to know Burke & Burke's *Hyper I/O* and RGB's BASIC for the hard drive exist in versions that work with Disto host adapters. The Disto, Owl-Ware, RGB and Ken-Ton Electronics systems are similar because they use the same variety of SASI and SCSI hard-drive controllers. Owl-Ware, RGB and Ken-Ton Electronics systems' host adapters are addressed to the same I/O port locations: $FF74 through $FF77. Disto's MEB products' I/O port addresses are a bit different. The MEB uses the SCS line to create its I/O port addresses, keeping the MEB ports in the range of $FF50 to $FF5F. Naturally, the Disto Super Controllers decode the SCS line for their floppy controller ports, so the controller registers are valid only in the $FF40 to $FF4F range and an image is not formed in the $FF50 to $FF5F area as it is with Radio Shack floppy controllers. Disto's 4-in-1 card's RS-232 port is not easily used with conventional Disk BASIC-based terminal programs because its I/O port address is different from the traditional addresses used by the Deluxe RS-232 Pak and subsequent clones.

However, the different port address poses no real problems under OS-9 because once a proper driver for the RS-232 port is installed, all OS-9 software calling the port can find it without any modification. The Disto hardware RS-232 port found on the 4-in-1 card uses the same 6551 UART chip as used by the Tandy Deluxe RS-232 Pak.

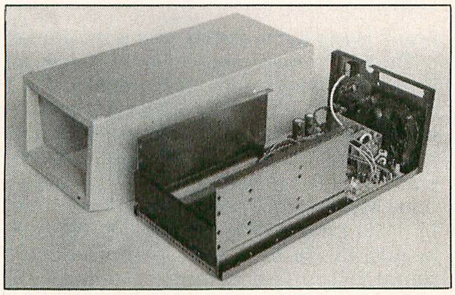
Arizona Small Computer Peripherals is a new company, dedicated to providing exceptional bargains on CoCo hard-drive systems. Using the Disto host adapter and software, along with a Xebec 1410A controller, it put together cost-effective hard-drive systems with CMI full-height 5-, 8-, 10- and 20-Meg hard drives. Some of the drives the company sells are brand new; others are used but tested thoroughly and sometimes reconditioned. Many of the Xebec controllers sold by Arizona Small Computer Peripherals are used. In some of its lowest priced systems, the company does not include a case for the hard drive, controller and power supply.

However, the company is able to offer full systems for under $150. (If you do not own a Disto Super Controller, you may have to spend more — as much as $100 more if you don't own a Multi-Pak.)

The people at Arizona Small Computer Systems have a full professional facility for repairing hard drives, including test equipment, and a complete working "clean room" in which drive "bubbles" can be repaired and drive platters replaced. If you send them your OS-9 system disk, they will configure their hard drive system for you. This way you'll need only turn on the drive and it will boot from the floppy drive. They are working on their own version of Disk Extended BASIC drivers for their systems. Dale Puckett has used the Disto hard drive system for quite a while, and it has performed reliably.

Frank Hogg Laboratories

Frank Hogg Laboratories has been selling OS-9 hard-drive systems longer than any other RAINBOW advertiser. In the past, however, these were for its QT line of 680XX systems, not the CoCo. It currently sells two different hard-drive systems for the CoCo. The economy model is the system designed by Burke & Burke. Frank Hogg Laboratories also sells, exclusively, a full-featured system engineered by Bruce Isted of Calgary, Alberta. This system is unique in several respects. First, it is the most expensive hard-drive system for the CoCo. For the price, however, several unique features are delivered.



Heavy duty power supply and case offered by FHL.

This system uses a Western Digital WD-1002-05 controller board. This unit is a high-performance item, fashioned for the mini computer and the high end of the microcomputer market. It features greater data transfer rate than the average SASI or SCSI controller board/host adapter arrangement. The controller board used also supports three hard drives. In addition to talking to up to three hard-disk drives, this board can support up to four double-sided floppy disk drives. The support provided is unusual because the system can talk to ordinary 360K or 720K 5¼- or 3½-inch floppy drives; the high-density, double data rate 1.2-Meg, 5¼-inch floppy drives; and the 1.44-Meg 3½-inch floppy drives. Although these drives are not supported in the system as delivered, tinkerers can alter certain jumper settings on the controller board and add a simple adapter-patch board to assign some of the floppy drives as high density and others as low density. At present, both the hard and floppy drives are supported under OS-9, and users must have a separate Radio Shack controller and floppy drives hooked to a Multi-Pak if they want to use DECB. However, software to make the system work under Disk BASIC is in the works. The floppy-drive controller in the FHL deluxe system is a no-halt controller, so when a floppy disk is accessed, no keyboard input or data coming in through the serial port is lost.

The Western Digital controller used in the FHL deluxe system can transfer data faster than the SASI/SCSI controllers used by all competing systems except those by Burke & Burke. The system can do this because it does not go through a handshake with the host adapter during data transfer. Data can be read or written to the Isted host adapter without checking the status of handshake lines for each byte. Additionally, Bruce Isted's system allows transfer of data between the CoCo and the host adapter two bytes at a time. While the FHL deluxe system is similar in configuration to the SASI and SCSI systems sold by others, this system uses a cable and a communication protocol between its host adapter and controller that is neither SASI nor SCSI, but rather a protocol unique to the Western Digital WD-1002-05 board.

FHL has also come out with a variation on this system, the Eliminator. This is a single card that plugs into the CoCo system port and provides two hardware serial ports, a parallel port, a real-time clock and the host adapter needed to work with the high performance Western Digital controller. The Eliminator uses CMOS logic chips so it will not need an external power source.

Frank Hogg Laboratories caters to tinkerers and sells only the critical hardware and software pieces of the system. This allows hackers to put together the system for less money if they have access to bargains in hard drives, WD-1002-05 controller cards, cases, power supplies, etc. Western Digital makes a variant of the WD-1002-05 controller card called the WD-1002-HDO card that is basically the same card without the components devoted to talking to floppy drives. Greg Law, SysOp on Delphi's OS-9 SIG, has been using one of these systems for some years, configured with high density floppy drives. He reports reliable service from it.

Owl-Ware

Owl-Ware's advertisements in RAINBOW promise "Proven Technology," and its hard-drive system confirms the claim. Its CoCo system has been available longer than any other CoCo hard-drive system.

The system was originally engineered by LR Technologies and consists of a host Adapter, which generates a SASI bus and is connected to one of several SASI or SCSI controller boards (which, in turn, is connected to and packaged with a hard-disk drive and power supply). LR Tech designed the host adapter. Owl-Ware has since obtained the rights to the LR Tech design and — after making some revisions to it — is producing the interface itself. The people at Owl-Ware tell me that the product is more fully SCSI than their older SASI device. They are even hinting about producing software and hardware packages to support tape backup units and CD ROMs on this SCSI bus.

The systems Owl-Ware sells include new hard-disk drives, which are *burned in* (tested in operation for some hours) before shipment. In addition, its interface is more complex electronically than those of its competitors. These factors make this product more expensive when ordered as a working system. However, like Frank Hogg Laboratories and most hard drive system vendors, Owl-Ware will cater to the tinkerer. It sells pieces of the system to those who want to make their own. The hacker package includes the host adapter, drivers for various different controller boards and a full source code listing of the drivers. (You need an OS-9 Level I assembler to use that listing.) It sells for under $120. If you want to forgo the testing done prior to shipping, you can have around $60 deducted from the price of the system.

Unlike the FHL deluxe system, Owl-Ware's system can be supported by three different software packages that allow operation under DECB. The company sells *Owl BASIC 3* for its hard-drive system. Implementations of DECB on Owl-Ware's hardware are also available from Burke & Burke, which has a version of its *Hyper I/O* that runs with this hardware. RGB Computer Systems' primary concern is support of Radio Shack's Disk BASIC, but it also has a version of its software that runs with the Owl-Ware hardware. The exact degree of compatibility and flexibility offered depends on which BASIC system software you get. All are fairly compatible, but none are totally compatible.

At this time, Owl-Ware's host-adapter card does not have a real-time clock, which will come as a disappointment to OS-9 users. However, the company has acquired rights to manufacture J&M's floppy controllers and plans on engineering and selling a single card that will be a floppy disk controller and a hard-drive host adapter. Its commitment to supporting OS-9 users will be extended by the introduction of a major word processor, said to be similar to Microsoft's *Word.*

The people at Owl-Ware maintain voice lines for support of their hardware and tell me that they will soon set up a 24-hour BBS to support their products. Rick Adams, author of several pieces of commercial Color Computer software and author of *RickyTerm* and *DelphiTerm*, owns an Owl-Ware hard-drive system. Since its arrival, the system has worked ruggedly and reliably.

RGB/Ken-Ton Electronics

Roger Krupski of RGB Computer Systems has a particular interest in supporting Radio Shack's DECB with the greatest amount of compatibility possible. His hardware is a SCSI host adapter for the CoCo (which he developed together with the folks at Ken-Ton), a standard SASI or SCSI hard-drive controller card, hard drive and power supply. The unique aspect of Krupski's system is the software. RGB's implementation of DECB is considered the most compatible. RGB also provides patches for some of the popular Disk BASIC application programs, which present problems for any hard drive implementation of DECB. Of course, RGB also provides OS-9 drivers. The RGB Computer System software supporting DECB on a hard drive is available in forms that work with hardware from Owl-Ware, Ken-Ton and CRC/Disto. However, versions are not currently available for the Burke & Burke system.

Ken-Ton Electronics has long sold CoCo products for industrial systems. Part of their business involves building complete Color Computer systems customized for particular business and user applications. This work has resulted in Ken-Ton's SCSI host adapter for the CoCo, which is included in RGB's systems. This host adapter features heavy gold contacts and is available with a real-time clock that uses a rechargeable lithium battery (say good-bye to battery replacement.) Optionally, users can purchase the Ken-Ton SCSI Interface in an open collector version. This allows more than one CoCo to access the controller and hard drive on the same system. Also, to support larger systems, Ken-Ton offers H-DOS. While very similar to RGB-DOS, this custom DOS features optimized commands, a larger sector space and storage of hard drive parameters in EPROM (instead of on the physical disk) to increase data security. Ken-Ton also sells a dual-com RS-232 port board that provides up to two RS-232 ports. Joe Scinta, the man behind Ken-Ton, is a savvy engineer who knows CoCo hardware inside and out.

Where to Go From Here . . .

Main Hard Drives Currently Being Sold

- Seagate ST-225 20 Meg
- Seagate ST-238 30 Meg (RLL)
- Seagate ST-251 40 Meg
- Miniscribe M-8425 20 Meg
- Miniscribe M-8438 30 Meg
- Miniscribe M-3650 40 Meg
- Miniscribe M-6085 70 Meg
- CMI 5206 5 Meg
- CMI 5412 10 Meg
- CMI 6426 20 Meg
- CMI 6639 30 Meg (non-RLL)

Commonly Supported Hard Drive Controllers

MFM	RLL
Adaptec 4000	Adaptec 4070
DTC-5150	Adaptec 2072
WD1002-SHD	DTC-5160
WD1002-GEN	WD1002-27X
WD1002-WX1	
Xebec 1410	

Arizona Small Computer Systems sells complete systems as well as the individual components that make up a hard drive system. All units include the Disto interface ($50), the WD1002-SHD controller ($75) and OS-9 drivers. In addition, all system drives are formatted under OS-9 and are shipped with approximately 1 Meg of public domain software on the drive. A 20-Meg system, including a CMI 6426 drive and a power supply and case ($50), sells for $350. A similar system with a 30-Meg drive (CMI 6639, non-RLL) is available for $425. Lower-end systems, sold with power supply but no case, are the 5-Meg system (CMI 5206, $60) for $120 and the 10-Meg system (CMI 5412, $75) for $160. All products carry a 180-day warranty.

Burke & Burke's main item of interest is an IBM PC bus-compatible interface, the CoCo XT, retailing for $69.95 without the real-time clock (RTC) option and $99.95 with the RTC. The CoCo XT includes drivers for both OS-9 and Disk BASIC. Other related products include *Hyper-I/O* ($29.95), *RSB* ($39.95) and the hardware XT-ROM ($19.95). All CoCo XT boards, built and tested by Burke & Burke, include a 90-day warranty.

CRC/Disto is offering the Disto Hard Disk Interface for $49.95. This interface offers the advantage of eliminating the Multi-Pak Interface while preserving access to most of the hardware accessory functions OS-9 users require. The MEB Adapter, used to carry this SCSI interface, is sold for $24.95. Alternatives to the MEB are the Super Controller I ($99) and the Super Controller II ($130). Both units feature an internal MEB to hold the hard drive interface. The Disto interface includes a 90-day warranty.

The Computer Center sells drive/controller kits that can be used if you want to build your own hard drive system. A 20-Meg ST-225 drive with the WD1002-GEN controller goes for $339, and a 40-Meg ST-251 drive with the same controller can be had for $499.

Frank Hogg Laboratories offers the Burke & Burke interface and optional extras at Burke & Burke prices. Additionally, FHL carries a full line of hard drive systems and components. Complete systems built around the Burke & Burke interface include: 20 Meg (using an ST-225 or Miniscribe M-8425) for $498, 30 Meg (Miniscribe M-8438) for $548 and 40 Meg (M-6085, full height) for $618. In the high-speed category, FHL offers deluxe systems built around its Eliminator interface ($199). These deluxe systems feature built-in capability to handle three hard drives and four floppy drives, including high-density (1.2 Meg and 1.44 Meg) floppy drives, in a no-halt fashion under OS-9. At present, the deluxe systems are strictly for use with OS-9. Systems, including the WD1002-05 high-speed controller ($199), are as follows: 20 Meg (ST-225 or M-8425) for $799, 40 Meg (M-3650) for $899 and 70 Meg (M-6085, full height) for $1335. All systems include a dual half-height power supply (60W with cooling fan) and case ($99.95), cable set and OS-9 Level I and II software. All units are fully tested and FHL warranties its products for one year.

Disk BASIC Software

At present, there are three sets of driver software to let you use hard-drive systems under DECB. RGB appears to have concentrated on Disk BASIC's use on a hard drive. The company divides the drive into however many standard 35-track disks can fit on it. The software allows you to cordon off some of the hard drive for use with OS-9. This approach has certain advantages and disadvantages. By making the virtual drives all 35-track, RGB gets around many compatibility problems caused by software whose file I/O does not use calls in Disk BASIC ROM. In most cases, the software gives you the 100 or more accessible virtual 35-track drives. For example, type `BACKUP 53 TO 105`, and the contents of virtual Drive 53 are backed up to virtual Drive 105. Also (via a software switch) bring in or out your four physical single-sided floppy drives (i.e., set things up so that drives 0 through 3 can be physical floppy or virtual drives actually part of the hard disk drive).

RGB's software offers exceptional compatibility. All implementations of Disk BASIC on a hard drive must be done by by burning an EPROM with a modified version of the DECB ROM code. RGB's version of this modified ROM is still only 8K in size, which means that it will not suffer compatibility problems from software that expects the upper 8K of the CoCo ROM address space to be unused. In addition, RGB's software stays almost completely out of the *base page* of RAM memory. Thus, its parameters are unlikely to conflict with variables that application software tends to store in the base page. (I believe RGB uses only a single byte in the base page of RAM for system variables.) Finally, RGB's software comes with a few patches not available elsewhere, to allow certain application programs (ones that don't go through `DSKCON` when they input or output disk sectors) to work with RGB software. When these patches are included, RGB states that its system will run *TW-80*, *TW-128*, *CoCo Max 3*, *Max 10* and other popular Disk BASIC software. BBS users, please note: RGB's implementation of Disk BASIC can be set up to automatically boot a particular program on power up. This means that after a power failure, your BBS can automatically restart itself from your hard drive.

The software offered by Owl-Ware and hinted at by Arizona Computer Systems is likely to be *similar* to the software offered by RGB systems. But RGB has had a long time to work bugs out of its system. This is not the case with the other offerings.

Burke & Burke offers an alternative to RGB systems. The approach is quite different and has its pros and cons. Under *Hyper I/O*, Burke & Burke formats the entire hard disk drive as an OS-9 hard disk. It then creates Disk BASIC devices in the form of OS-9 binary files on the hard drive. Under *Hyper I/O*, these virtual disks can be any size the user cares to make them. Steve Bjork reports that it is desirable to make at least one or two of them standard 35-track single-sided virtual drives. However, you can define drives a megabyte or more in size. If you are using 40-track double-sided floppy drives under Disk BASIC, you can define similar-sized devices on the hard disk.

The Burke & Burke approach offers a few nice features. First, you can change the proportions of the hard

Howard Medical carries a 20-Meg system retailing for $499. This system is built around the Burke & Burke approach and includes an ST-225 20 Meg drive, Burke & Burke interface, DTC-5150 controller, and a case and power supply. The drive is tested and formatted before shipping and the system is warranted for one year. If you want the RTC option for the Burke & Burke interface, include $20. In addition, Howard Medical is offering *Hyper-I/O* ($29.95), *RSB* ($39.95) and the XT-ROM ($19.95).

Ken-Ton Electronics offers a SCSI interface and will develop custom hard drive systems on request. Because of the many options available, you are invited to call for specific information. The Ken-Ton SCSI Interface currently retails for $89 without the real-time clock option and $119 with the clock installed. This true-SCSI interface will work with most any SASI or SCSI controller and allows control of multiple devices (hard drives, floppies, CD ROMs, etc.). It features real gold contacts. The clock option uses a rechargeable Lithium battery so replacement is unnecessary. The unit is also compatible with RGB-DOS, H-DOS (an extension of RGB-DOS), Owl-DOS and LR Tech software. Ken-Ton will supply custom drivers for the interface at the user's request. The interface is available in an open-collector version ($10 extra), which allows multiple CoCos to drive SCSI devices. Ken-Ton's software will not run with the Burke & Burke interface.

Owl-Ware has made some refinements to the LR Tech interface and the result has been dubbed the LR Tech/Owl Interface ($99). This host adapter will drive the Adaptec SCSI controllers. Among many other controllers, it will also easily drive the Omti 5000 series of controllers, allowing use of hard drives, floppies and other devices. A 10-year clock option is being offered for $25. Among several systems, Owl-Ware is offering a 20-Meg ST-225 ($239) complete with controller, LR Tech/Owl Interface, cables, case and power supply ($95) for $599. A similar 40-Meg, M-3650 system sells for $725. These systems are available in kit form for $549 and $659, respectively. Alternatively, they can be had in kit form with the Burke & Burke interface for $489 and $609. All assembled systems are formatted and tested before shipping. An optional product is Owl BASIC, a hard drive BASIC, selling for $35 with a hard drive purchase or $79 separately. Owl-Ware currently warrants drives for one year and all other products for six months.

Microcom Software sells both the Burke & Burke line and the Disto line of hard disk products. In addition, a complete 20-Meg system (ST-225) with the Burke & Burke interface goes for $509. For $539, a complete 30-Meg system (ST-238) is available. Microcom sells a separate case and power supply ($119) and the WD1002-GEN and WD1002-27X controllers for $79 each. The Seagate drives (with controller and cables) are sold as follows: 20-Meg ST-225 for $299, 30-Meg ST-238 for $329 and the 40-Meg ST-251 for $439. Microcom also offers a Disto version of Burke & Burke's *Hyper-I/O* for $29.95. All products listed are warranted for 90 days.

MicroWorld sells the ST-225 20-Meg drive for $259 or $299 with a WD1002-WX1 controller. The 30-Meg ST-238 RLL drive retails for $309 or $349 with WD1002-27X controller. Also, the 40-Meg ST-251 drive goes for $399 (without controller only).

Perry Computers sells the bare, 20-Meg ST-225 for $239 and the 20-Meg Miniscribe M-8425 for $240. The bare 40-Meg ST-251 drive is available for $409.

RGB Computer Systems can supply complete hard drive systems and software. Because of the different equipment available, you are invited to call RGB for specific information. RGB Computer Systems is also offering RGB-DOS, a hard drive-compatible DOS, at a price of $29.95. RGB-DOS has many of the features found in other alternate DOSs for the CoCo in addition to added commands for hard drive access. Because of its design, RGB-DOS works equally well with the CoCo 1, 2 and 3, and it will work with floppy-only systems. In addition to the inclusion of an non-OS-9 autoexec file, it allows users to boot OS-9 straight from the hard drive. Like Ken-Ton, RGB Computer Systems' software will not run with a Burke and Burke interface.

True Data Products offers parts and pieces of hard drive systems. There you can find the WD1002-WX1 controller for $99. The ST-225 20-Meg bare drive retails for $249 ($299 with controller) and the bare 40-Meg ST-251 can be had for $399 ($459 with controller). Alternatively, True Data sells a power supply, case and controller combo for $199. ☐

drive in OS-9 and Disk BASIC use (i.e., by killing or creating another of these *virtual devices*, you can add or subtract space allocated to Disk BASIC). This is not the case with the RGB software; it locks you into a particular partition at the start. Second, software and text files written under Disk BASIC are relatively accessible to OS-9 programs.

However, the ROM is 16K, which means it can be used only with third-party controllers. To use it with a Radio Shack controller requires a special adapter. Because *Hyper I/O* uses more RAM-base page locations for its system variable, there is more potential for compatibility problems with other software, and at present Burke & Burke does not have as many specific patches for popular software offerings as does RGB Computer Systems. Please note: Some of the fixes that RGB sells with its Disk BASIC system software will fix the target programs, so they work with Burke & Burke's *Hyper I/O*, too. (These patches are not sold separately by RGB; you have to buy the entire package.)

Although I imply that Burke & Burke's system may have some compatibility problems, Steve Bjork reports that *Hyper I/O* does provide a satisfactory degree of compatibility with application software designed to work with Disk Extended Color BASIC.

Technical Hints for Tinkerers

If you are making your own hard drive system with pieces of one of the systems I have mentioned, the following technical information may be of help to you. The following SASI and SCSI controllers work with CRC/Disto host adapters:

SASI:	WD1002SHD XEBEC 1410A DTC (all of the 520 series)
SCSI:	Rodime 650 series of drive plus controller Seagate N series of drive plus controller Adaptec 4000A (MFM type) and 4070(RLL type)

- Most of these should also work with Owl-Ware and Ken-Ton/RGB host adapters, but contact the manufacturer in question to make sure.
- Tony DiStefano seems to prefer the Adaptec controller boards.

Name	**Username**	**Company**
Burke, Chris	COCOXT	Burke & Burke
Krupski, Roger	HARDWAREHACK	RGB Computer Systems
DiStefano, Tony	DISTO	CRC/Disto
Isted, Bruce	BRUCEISTED	Designer of the FHL Deluxe System
Vishinski, Tom	OWL1	Owl-Ware
Law, Greg	GREGL	SysOp of the OS-9 SIG
Koonce, Tim	TIMKOONCE	Author of *VTerm*, A knowledgeable OS-9 programmer and hardware expert
Darling, Kevin	KDARLING	SysOp on CompuServe's OS-9 SIG
Adams, Rick	RICKADAMS	OS-9 technical consultant

Table 1: Whom to Contact on Delphi

The Burke & Burke host adapter can be used with the following IBM PC controller boards:

Western Digital:	
WD1002-WX1	(MFM type)
WD1002S-WX2	(MFM type)
WD1002-27X	(RLL type)
WD1002-GEN	(MFM type)
DTC:	
DTC5150CRH	(MFM type)
DTC5160CRH	(RLL type)
Adaptec:	
ACB2072	(RLL type)

The OMTI 5520 controller will also work with the Burke & Burke adapter, but it will not support the Burke & Burke boot ROM. If you use this controller, you must boot your hard-drive system from a floppy disk drive. Actually, this is not as much of a problem as some might think, and many seasoned OS-9 users prefer booting off a floppy anyway, for the added flexibility it offers.

If you are packaging your hard drive and controller board in a case, Frank Hogg warns you to beware of potential problems. Mount your hard drive controller in a plane that is at least ½-inch away from the the hard drive and its logic board. If you do not do this, you may get unreliable operation due to interference between the controller board and the logic board. If you package a floppy drive in the same case with the hard drive, put the logic board of the floppy drive next to the metal side of the hard drive — not next to its logic board. Placing the logic board of the floppy drive close to the logic board of the hard drive can cause interference and unreliable operation.

As in all systems, it is best to keep inter-connecting cables as short as possible. While SASI and ST506 cables have been known to work at lengths of 6 feet or more, I suggest lengths be kept under 3 feet for each cable.

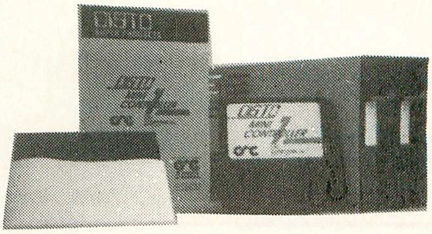
All the companies and people involved in the CoCo hard drive business seem reputable and conscientious. At the beginning of system development, almost all the developers encountered problems with their equipment. For example, when the CoCo 3 was introduced, none of the developers realized the timing of the SCS line on the CoCo 3 was different from the timing of the SCS line on the older CoCo models. Specifically, devices using the SCS line on a CoCo 3 must gate that line with the high portion of the E-clock signal. In some of their early products for the CoCo 3, both Disto and Burke & Burke failed to do this, and maddeningly intermittent unreliable operation resulted. Eventually both Chris Burke and Tony DiStefano solved this subtle problem. Although all their current products implement the required gating of the SCS line, in the beginning, these problems caused ill will between them and some customers and dealers. I urge patience should problems arise and remind you that even subtle problems can be solved.

For more details on hard drives, refer to Kevin Darling's article on hard drive systems, published in the OS-9 Special Interest Groups on Delphi and CompuServe. It was a valuable reference in writing this article. When you consider getting a system, contact the maker first. Delphi users can contact many of the principals online. Refer to Table 1 for a list of such people, their usernames and their companies or qualifications. Of course, you can contact me, MARTYGOODMAN. I'm always available on Delphi to answer questions.

Color Computer I, II, III

Free Software for Drive 0 Systems

CoCo Checker...Test roms, rams, disk drives and & controller printer, keyboard cassette & more.
Tape/Disk Utility...Transfers disk to tape and tape to disk.



159^{95} Drive 0

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- 2 Drive Cable
- Gold plated contacts
- Controller & manuals

179^{95} Drive 0

- Double Sided Slim Line Drive
- Case holds 2 slim line drives
- Heavy Duty Power Supply
- 2 Drive Cable
- Gold plated contacts
- Controller & Manuals

269^{95} Drive 0 & 1

- 2 Double Sided Slim Line Drive
- Case holds 2 slim line drives
- Heavy Duty Power Supply
- 2 Drive Cable
- Gold plated contacts
- Controller & Manuals

Other Drive Specials

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Slim Line Drive Ps/Case	139^{95}
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Disk Controller	59^{95}

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Disk Controller	59^{95}
10 Diskettes with free library case	9^{95}

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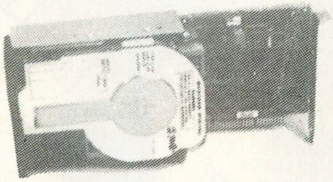

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30 meg	349.95	64 meg	599.95

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Enjoy the game on and off the green

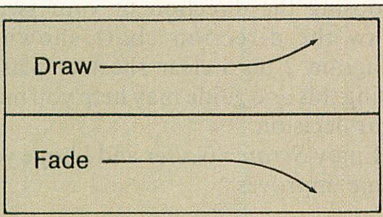
Teed Off

By Larry Duggins

Have you ever dreamed of consistently hitting a golfball 250 to 300 yards and having it land in the fairway? Have you imagined your shot sailing past a fairway bunker or your second shot clearing the pond and landing safely on the green of a par 5 hole? You don't have to just dream anymore. *Scratch Golfer*, a golf simulation that makes use of text and Hi-Res screens, can make your dreams come true.

To begin playing the game, just load, run and press ENTER. You'll be on your way. (The program is long and a little complicated, so watch for typos if you typed it in.) Follow the screen prompts to enter all necessary information for each shot.

Scratch Golfer's objectives are the same as those of regular golf: To play the 18-hole round of golf in as few strokes as possible. With the exception of putts, all shots will be determined by data entered by the player. The number of putts taken by the player is determined by a system of percentages based on the distance between the ball and the hole once it lands on the green.

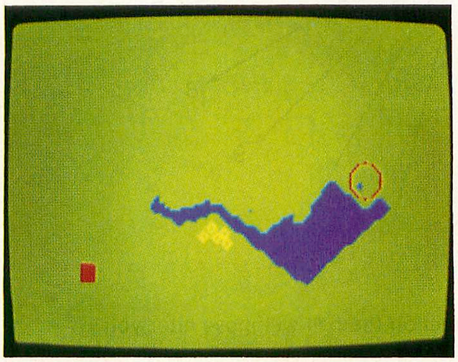


No matter which way you face, for a right-handed golfer, a draw curves to the left and a fade curves to the right.

Diagram 1: Draw and Fade

After the title screen appears, the computer determines if you have a disk drive connected. The computer will ask whether or not your computer will accept the speed-up poke. Press Y to answer *yes* and N to answer *no*. The program assumes that you are a right-handed golfer and will ask you to identify your normal shot. Since it is rare for a golfer to consistently hit a ball straight, you will need to indicate the direction in which the ball usually curves in the air. Press D for *Draw* and F for *Fade*.

Once you have answered these questions, the title screen is replaced by Screen 1, which contains data about the hole, wind conditions, lie of the ball, distance to the hole and average distances you can expect from each club if your yard length is six. At this screen, you will enter the information needed to play each shot. Screen 2 is a graphic representation of the hole. Toggle between screens 1 and 2 by pressing S.



Screen 3 appears after you have played a hole. It offers you statistics about the way you played the hole. Screen 4 is your scorecard. (Sorry, you can't tear it up if things are going badly.) The number to the right of your score is a running tab, identifying how far above or below par you are: A number in inverse video represent an under-par score; regular numbers represent over-par scores; and an E represents even par.

The final screen, Screen 5, appears at the end of the last hole. It displays the final statistics for each hole. This information can be saved to disk.

At the first screen, you will be prompted by a flashing question mark for four different values. The program first asks you to select a club. Make your selection and press ENTER. Next, you'll need to enter the initial direction of your shot. The program then asks for the length of arc. Values 2, 3 and 4 are chip and pitch swings, and values of 5, 6 and 7 are full swings. You cannot draw or fade with an arc value less than 5. Therefore, if you select a value of 4 or less, the program places an asterisk on the screen for "Type of Shot." If you choose a high value, you must respond to the prompt by pressing F for Fade or D for Draw. Your normal shot (entered while in Screen 1) is the best bet; however, if you like to gamble, enter the opposite shot. Since you are a scratch

Golf Gab

Terminology:

Draw: For a right-handed golfer, a draw is a shot that curves from right to left. (See Diagram 1.)

Fade: For a right-handed golfer, a fade is a shot that curves from left to right. Note: For a left-handed golfer, a draw and a fade are just the opposite.

Hazard: Any bunker or water hazard.

Bunker: An area of bare ground — often a depression — usually covered by sand. They are yellow in this simulation.

Water Hazard: Any sea, lake, pond, stream, ditch, etc. They are blue in this simulation.

Rough: Taller grasses bordering the fairway. These are large yellow areas.

Out of Bounds: Any shot that comes to rest off of the course. In this simulation, you are out of bounds when the ball goes off the graphics screen.

Teeing Grounds: A rectangle, two club lengths in depth, the front and side of which are defined by the outer limits of two markers. This is represented by the red rectangle.

Direction of Shot: The initial path the ball will take when first struck. You can enter any value from zero to 23. (See Diagram 2.)

Length of Arc: The length of arc is determined by how far back you swing the club. Your choice of swing ranges from two to seven.

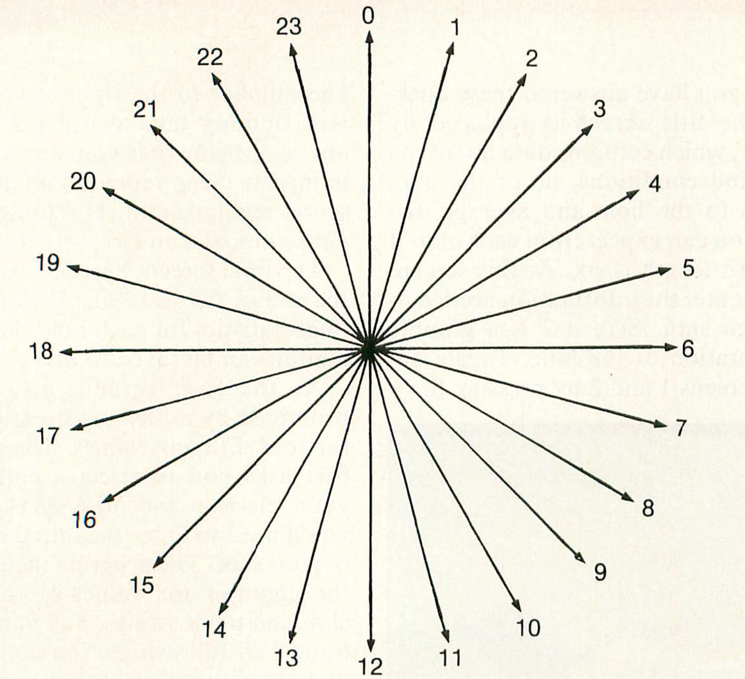
Lie: The lie of the ball refers to the degree of difficulty that enters into the shot caused by how the ball is resting on the ground. If the ball is nested in tall grass or plugged in the sand bunker, the shot is more difficult. There are three types of lies: good, fair or bad.

Penalties:

Water Hazard: If a ball lands in a water hazard, the player will be given a one-stroke penalty. The ball will be placed near the hazard on approximately the same line as the ball took upon entering the hazard.

Out of Bounds: The player takes a one-stroke penalty and must replay the ball from where it was originally struck.

Larry Duggins currently teaches fifth grade in Kettering, Ohio. He recently returned to school to work on a computer science degree. Larry enjoys golf and has a handicap of two.



This diagram shows you the initial direction the ball will move after you enter one of the 24 possible direction values.

Diagram 2: Swing Direction

golfer, you have a good chance with either swing. Once you have pressed the key corresponding to the type of shot, press ENTER if you are ready to begin or the space bar if you need to change any values.

Once you are ready to begin, the program will pause for a few seconds. The second screen appears, and you see your shot. After the ball lands, the program pauses while the ball flashes on the screen. Press S to return to the first screen to set up your next shot.

Philosophy, Hints and Strategies

To play this golf simulation, all you have to do is choose the club and the arc and direction of the screen. However, it's not that easy. The program takes into consideration a number of wild cards: missed and inaccurate shots, the lie of the ball, etc. For instance, I have designed a "distance-versus-accuracy" factor into the length of the swing. The farther you swing the club back, the farther the ball can go. However, the the greater the length arc, the greater the chance of a missed shot or of a greater curve than you expect. (See Table 1.)

Screen 1 offers the distances for each club as they apply to a good lie of the ball. Be careful if you have a fair or bad lie and intervening water. Note: If you have a bad lie with the message "Be Careful," the ball is either plugged in the sand or nestled in deep grass. In these instances, your only safe shot is with your #10 club.

Length of Arc	Possible accuracy	Potential distance	Possible amount distance can vary
5	Best	Fair	Least
6	Good	Good	↓
7	Fair	Best	Most

Table shows how full swing length of arc values influence accuracy and distance.

Table 1: Swing Length of Arc Values

The winds play a big part in club selection and the direction of the shot. Don't be concerned about mild winds, but consider the speed and direction of stronger winds when entering your data. In addition, you might want to try longer distance clubs and a short arc to get some of the distances under 120 yards. Finally, if you are having trouble choosing the direction of your swing, draw the direction chart shown in Diagram 2 on a clear sheet of plastic. Using this as a guide may help you make your decision.

Enjoy *Scratch Golfer* and I hope your game improves.

(Questions or comments about this program may be directed to the author at 2706 Symphony Way, West Carrollton, OH 45449. Please include an SASE when requesting a reply.) □

13	190	117	148	255	221
19	17	124	154	267	203
28	127	134	195	277	105
40	232	143	42	287	230
56	152	155	79	301	27
66	187	169	52	311	123
77	203	192	223	321	129
85	56	207	92	327	144
97	107	225	37	339	78
107	65	237	77	END	134

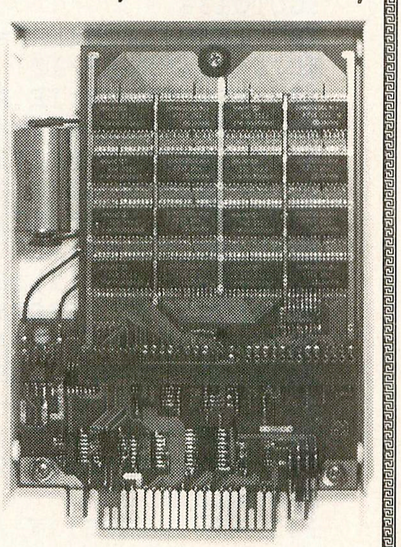
The Listing: GOLFER

```
0 '      SCRATCH GOLFER
1 '  (C) 1986 BY LARRY DUGGINS
2 '      2706 SYMPHONY WAY
3 '        W. CARROLLTON OH
   COPYRIGHT 1989, FALSOFT,INC
4 GOSUB342
5 CLS:PD=PEEK(&HC000):IF PD=68 T
HEN INPUT"DOES YOUR COMPUTER ACC
EPT THE   SPEED UP POKE WITH YOU
R DRIVE   CONNECTED (Y/N)";AQ$EL
SE INPUT"DOES YOUR COMPUTER ACCE
PT THE   SPEED UP POKE (Y/N)";AQ
$
6 IF AQ$="Y"THEN POKE65495,0
7 X=RND(-TIMER):CLS:INPUT"WHAT T
YPE OF SHOT DO YOU WANT ASYOUR N
ORMAL ONE...PRESS (D) FOR DRAW
 (F) FOR FADE";SS$
```

```
8 IF SS$="D"OR SS$="F"THEN12ELSE
7
9 DATA0,1,2,3,4,2,1,5,3,4,5,2,3,
4
10 DATA4,1,0,3,2,3,4,5,0,1
11 DATA5,536,4,468,5,596,3,152,4
,440,4,416,4,424,3,212,4,376,4,4
20,4,292,4,388,5,532,4,368,3,240
,4,424,5,640,3,164
12 WD=RND(7)+1:WS=RND(20)+1:IF W
D=1 THEN WD$="N"ELSEIF WD=2 THEN
 WD$="NE"
13 IF WD=3 THEN WD$="E"ELSEIF WD
=4 THEN WD$="SE"
14 IF WD=5 THEN WD$="S"ELSEIF WD
=6 THEN WD$="SW"
15 IF WD=7 THEN WD$="W"ELSEIF WD
=8 THEN WD$="NW"
16 G$="H5L1H1L2H2U1H2U1L1H3L1H1L
1H1L1G1D1G1D1G1D1G1D1G1D1G2D1G2D
1F1D1F1D1F1D1F2D1F3D1F3D1F3R3F2R
3E2R3E5U3E3U3H3U2":F1$="G3D2G2D3
F3R4F3R4F6R3E4R3F2R2E4R4E3R5F14R
4F12R4F12R4F10R3F2R3F1R2E16R3E12
R3E10R3E8R3E8R3"
17 GW$="E2R2F3R2F3R2F2D2G5D2G2L3
G6L2H4U3H5U3E8":FW$="G14L2G6L2G4
D3G5D3G8D3G5D4G2D3G1D2G1D1F2D2F2
D2G2D2G1D3F2D3F3D2G1D2R2E1R3E4R2
U2E2U2E2U2H2U3E6U2H2U3H2U2H3U2E5
U2E7U2E4U2E4U2E3U2E4U2E6U2E2U2L3
":GS$="L2G2L2G3D3G3D3F4R4F2R4E3R
3U2E6U2H4U1H3G2L3
18 SR$="R3F2R3F2R3F2R1F2D2G3L2H3
L2H4L2H2U4":SF$="H3U2H2L2H2U2L2G
3D2G2D3F3D2F2R4F2R2E3U4":FB$="L3
G2L2G2L2G5D1G2D2F6":LB$="F3R3D2F
3R3E3U2H6L2H3L4H2L4G3L2G6L3G4L2G
2D6F4D3F4R6E3H4"
19 FT$="H1L1H1L2H2L1H2H3U2H4U2H3
L2G3L2G4D2F6R3F5R2F3R2F4R2U2R2E3
U2":SM$="H3L2H1L1G2L1G1D1G1D1F2R
1F1R2E2R2U1E2":SL$="H4L2H2L2D3L2
D3F3D2F3D2L2D2F3R3E3U2E2R2U3H8":
FL$="R2D5R4D3R5D2R6E2R7E2R5E3R5D
3R7F8R5F7R6F5R3E6R3E5R3E3F3D4R5E
7U4E8U3E7R5F9R3F10R4E7R5F10
20 G4$="F9R2F4R2F3R2F1R4F1R3E1R2
E1R3E2R2E2U1H2U2H1U1H3U1L2H1L1H2
L2H2L4H1L2H1L2H4L1H2L1G2L2G4D2G2
D2":GR$="U2H2U1H2U1L3H1L3G2L2G2D
3F4D2F3R4E3R2E2U1"
21 CLS:PRINT@200,"***ONE MOMENT*
**":DIM LE(18),ST(18),TS(18),PS(
18),NP(18),WD(30),PA(18),S1(18),
SC(18),TR(18):HO=1:CP=72:CT=1:RP
=109:PV=1134:SZ$=STRING$(32,131)
:BS$=STRING$(64,32):BL$="  ":AT$
=STRING$(32,42):GF=1
22 FOR X=0 TO 23:WD(X)=X:NEXTX:F
OR X=1 TO 24:READ A:NEXT X:FOR X
=1 TO 18:READ PA(X),LE(X):NEXT X
:RESTORE
23 FX=0:FY=0:FT=0:GOSUB241
24 PMODE3,1:PCLS1:RF=.99:ON HO G
O SUB26,33,42,54,63,69,73,84,79,
88,92,95,100,104,107,110,114,119
25 GOTO121
26 LINE(13,157)-(23,170),PSET,BF
27 DRAW"BM70,109;XF1$;BM70,109;X
FL$;"
28 CIRCLE(230,99),14,4:HX=226:HY
=103:CIRCLE(HX,HY),2,3
29 CIRCLE(104,138),5,2:CIRCLE(12
2,143),5,2:CIRCLE(120,136),5,2:C
IRCLE(115,139),5,2:CIRCLE(110,13
2),5,2
30 PAINT(210,138),3,4
31 COLOR1,1:DRAW"BM10,180;XD1$;B
M70,109;XF1$;BM70,109;XFL$;"
32 GOTO121
33 HX=192:HY=125:LINE(26,41)-(42
,49),PSET,BF
34 CIRCLE(196,133),16,4,1.45:CIR
CLE(HX,HY),2,3
35 H$="L2U1L3U1L4U1H3U1L2H3U1L2U
1L5U1H2L4U1H2L7H1L4H2L4H1L5G2L4G
2L4H3L4H2L3G2L3"
36 R$="R2F2D3R5F5R4F4R4F2D2F2D2E
1U2R4F5R3E4R3E2R3E6R3E4"
37 DRAW"BM98,91;XR$;BM152,60;A2;
XFT$;BM206,114;A3;XGW$;BM136,71;
XSM$;BM190,113;A0XH$;BM128,75;XS
M$;":PAINT(170,72),2,4:PAINT(218
,110),3,4:PAINT(116,95),2,4
38 PAINT(120,74),2,4:CIRCLE(170,
108),24,4,1.45,.17,.49:PAINT(172
,130),3,4
39 CIRCLE(170,108),24,1,1.45,.17
,.49:PAINT(137,76),2,4
40 COLOR1,4:DRAW"BM152,60;A2;XFT
$;BM206,114;A3;XGW$;BM98,91;A0;X
R$;BM190,113;XH$;BM136,71;A3;XSM
$;BM128,75;A0XSM$;"
41 GOTO121
42 HX=72:HY=18:CIRCLE(HX,HY),2,3
43 LINE(232,139)-(242,149),PSET,
BF
44 W$="F3D2F6D3F3D3F4D4G6L5G4L6U
3G2L4U4E4U3R2E2U3R4H4U2G1U4E2H4U
3H3"
45 DRAW"BM118,0;A0;XW$;BM160,100
;XSR$;BM166,95;XSL$;":PAINT(163,
103),2,4:PAINT(166,98),2,4:PAINT
(170,106),2,4:PAINT(160,107),2,4
46 PAINT(118,4),3,4
```

```
47 DRAW"BM76,33;A1;XG$;"
48 DRAW"BM176,82;A2XSF$;"
49 DRAW"BM138,90;A1XFW$;"
50 PAINT(84,55),2,4:PAINT(180,86
),2,4
51 CIRCLE(59,29),12,,1.22,.10,.7
:PAINT(54,27),3,4:CIRCLE(59,29),
12,1,1.22,.10,.7
52 COLOR1,1:DRAW"BM118,0;A0XW$;B
M138,90;A1XFW$;BM160,100;A0XSR$;
BM166,95;XSL$;BM176,82;A2XSF$;"
53 GOTO121
54 HX=110:HY=76:CIRCLE(HX,HY),2,
3:LINE(52,100)-(59,108),PSET,BF
55 WL$="F30D4F10D4F10D3F7D2F9D5F
3D3F7R5F3R5F4R3E2U7"
56 WR$="F10D2F8R3F4D2F8R2F10R3F4
R3F1R4F2R5F4R3F2R4F1R5F1R3F1R3F1
R4"
57 WG$="D1F4R2F6R1F5D1F3R1F7R2F2
D2F3"
58 WB$="R5F2R5F1R6F2R4F2R6F3R5F1
R3F1R4E2U3H5"
59 DRAW"BM20,0;A0XWL$;BM30,0;XWR
$;BM82,60;XWG$;BM82,60;XWB$;":PA
INT(25,0),3,4
60 DRAW"BM120,78;XGR$;"
61 COLOR1,1:DRAW"BM20,0;XWL$;BM3
0,0;XWR$;BM82,60;XWG$;BM82,60;XW
B$;"
62 GOTO121
63 HX=85:HY=46:LINE(138,149)-(14
8,157),PSET,BF:CIRCLE(80,40),16,
4:CIRCLE(HX,HY),2,3
64 DRAW"BM111,86;S6;XSL$;":LS$="
H3L2H2G3D2L2F3R3F2R3E2U2":DRAW"B
M93,86;XLS$;":PAINT(112,95),2,4:
PAINT(93,89),2,4
65 DRAW"BM124,75;S8;XSR$;":PAINT
(142,86),2,4
66 GT$="G3D2G2D2F3R2F1R3F2D2F2R3
E2R2E3U2E2U3H2":DRAW"BM66,50;S4;
XGT$;":TR$="E3R2E2R2F3R2F2D3R2D2
G3L2G2L2H1L3HL3H2":DRAW"BM96,43;
XTR$;":PAINT(66,55),2,4:PAINT(96
,47),2,4
67 COLOR1,1:DRAW"BM111,86;S6XSL$
;BM93,86;XLS$;BM124,75;S8XSR$;BM
66,50;S4XGT$;BM96,43;XTR$;"
68 GOTO121
69 HX=62:HY=122:LINE(205,40)-(20
8,46),PSET,BF:CIRCLE(60,124),12,
4:CIRCLE(HX,HY),2,3
70 DRAW"BM118,82;A1S6XSF$;BM134,
108;A0XSF$;BM63,106;A2XSF$;":PAI
NT(118,80),2,4:PAINT(130,110),2,
4:PAINT(68,107),3,4
71 COLOR1,1:DRAW"BM118,82;A1;XSF
$;BM134,108;A0;XSF$;BM63,106;A2;
XSF$;"
72 GOTO121
73 HX=166:HY=40:LINE(50,130)-(58
,138),PSET,BF:CIRCLE(HX,HY),2,3:
CIRCLE(168,42),13,4
74 DRAW"BM104,89;A1;S4;XFT$;BM12
4,104;A0;S6;XSM$;BM126,108;A2;XS
M$;BM126,88;A3;XSM$;BM151,79;A1;
XSR$;BM155,45;A0;XSM$;BM154,39;A
1;XSM$;BM184,40;XSM$;BM186,55;A0
;XSM$;":PAINT(101,86),2,4
75 PAINT(117,105),2,4:PAINT(129,
108),2,4:PAINT(124,93),2,4
76 PAINT(148,84),2,4:PAINT(147,4
5),2,4:PAINT(150,32),2,4:PAINT(1
83,37),2,4:PAINT(185,54),2,4
77 COLOR1,1:DRAW"BM104,89;A1;S4;
XFT$;BM124,104;A0;S6;XSM$;BM126,
108;A2;XSM$;BM126,88;A3;XSM$;BM1
51,79;A1;XSR$;BM154,39;A1;XSM$;B
M184,40;XSM$;BM155,45;A0;XSM$;BM
186,55;A0;XSM$;"
78 GOTO121
79 HX=60:HY=122:CIRCLE(HX,HY),2,
3:LINE(170,40)-(179,50),PSET,BF:
CIRCLE(58,121),11,4
80 DRAW"BM124,122;A1S4XSL$;":PAI
NT(120,120),2,4
81 DRAW"BM118,35;A0XFW$;BM54,101
;A2XSF$;BM140,91;A1XSR$;BM119,99
;A3XSM$;BM108,112;A2XSM$;":PAINT
(111,111),2,4:PAINT(121,106),2,4
:PAINT(116,40),3,4:PAINT(63,107)
,2,4:PAINT(138,94),2,4:COLOR1,1:
DRAW"BM118,35;A0XFW$;BM54,101;A2
XSF$;BM140,91;A1XS$;
82 DRAW"BM119,99;A3;XSM$;BM108,1
12;A2;XSM$;BM124,122;A1;XSL$;BM1
40,91;A1XSR$;
83 GOTO121
84 HX=68:HY=65:LINE(172,56)-(178
,64),PSET,BF:CIRCLE(68,62),10,4:
CIRCLE(HX,HY),2,3
85 CIRCLE(75,75),4,2:CIRCLE(70,7
8),4,2:CIRCLE(63,74),4,2:CIRCLE(
54,70),4,2
86 DRAW"BM68,49;A2S4XFT$;":PAINT
(82,53),2,4:COLOR1,1:DRAW"BM68,4
9;XFT$;"
87 GOTO121
88 HX=107:HY=50:CIRCLE(HX,HY),12
,4:LINE(139,148)-(151,158),PSET,
BF:CIRCLE(HX,HY),2,3
89 DRAW"BM108,37;A0XFB$;BM110,37
;XLB$;BM122,81;S6;XSL$;BM146,91;
A2;XSM$;":PAINT(96,40),2,4:PAINT
(118,87),2,4:PAINT(158,92),3,4
90 COLOR1,1:DRAW"BM108,37;A0;S4;
XFB$;BM110,37;XLB$;BM122,81;S6;X
```

```
SL$;BM146,91;A2;XSM$;"
91 GOTO121
92 HX=146:HY=40:DRAW"BM157,42;A0
S4XGR$;":LINE(14,70)-(22,82),PSE
T,BF:CIRCLE(HX,HY),2,3
93 DRAW"BM90,124;A2XFW$;BM166,38
;XSR$;":PAINT(164,35),2,4:PAINT(
110,104),3,4:COLOR1,1:DRAW"BM90,
124;A2;XFW$;BM166,38;XSR$;"
94 GOTO121
95 HX=48:HY=65:CIRCLE(HX,HY),2,3
:LINE(176,130)-(184,140),PSET,BF
:CIRCLE(50,62),11,4
96 WO$="S6L2H3L6H3U4E3R2E3R6F6D4
G6":DRAW"BM106,99;A0XWO$;":PAINT
(100,91),3,4:DRAW"BM106,99;C1XWO
$;"
97 DRAW"BM38,63;C4A3S6XSM$;":CIR
CLE(96,101),4,2:PAINT(42,70),2,4
98 COLOR1,1:DRAW"BM38,63;A3;XSM$
;BM70,63;S4A0XWF$;"
99 GOTO121
100 HX=198:HY=178:LINE(120,45)-(
132,53),PSET,BF:CIRCLE(HX,HY),2,
3
101 DRAW"BM198,169;S4;XGS$;BM106
,123;A3;XFW$;BM180,101;A3;XFT$;B
M177,128;A2XSM$;":PAINT(122,138)
,3,4:PAINT(182,104),2,4:PAINT(18
1,130),2,4
102 COLOR1,1:DRAW"BM106,123;A3;X
FW$;BM180,101A3XFT$;BM177,128;A2
XSM$;"
103 GOTO121
104 HX=105:HY=139:CIRCLE(HX,HY),
2,3:LINE(140,42)-(150,50),PSET,B
F:CIRCLE(HX,HY),9,4,1.3
105 DRAW"BM126,129;S6A0XSL$;BM83
,120;A3;S8;XSR$;BM132,121;S4;A2;
XGS$;":PAINT(134,118),2,4:PAINT(
124,140),3,4:PAINT(90,112),3,4:C
OLOR1,1:DRAW"BM126,129;S6A0XSL$;
BM83,120;A3;S8;XSR$;BM132,121;S4
;A2;XGS$;"
106 GOTO121
107 HX=124:HY=128:CIRCLE(HX,HY),
2,3:CIRCLE(128,126),14,4,.66:LIN
E(124,64)-(132,72),PSET,BF
108 CIRCLE(110,126),5,2:CIRCLE(1
10,120),5,2:CIRCLE(105,123),5,2:
CIRCLE(112,115),5,2:CIRCLE(113,1
31),5,2:CIRCLE(118,136),5,2:CIRC
```



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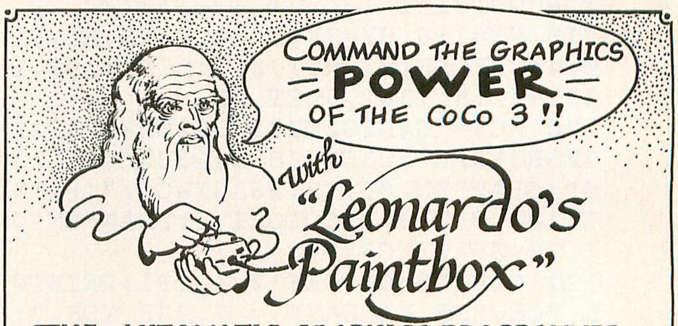
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```
LE(107,128),5,2:CIRCLE(126,138),
5,2
109 GOTO121
110 HX=108:HY=153:CIRCLE(HX,HY),
3,3:LINE(96,40)-(112,48),PSET,BF
:CIRCLE(110,152),11,4,1.33
111 C1$="H6U3H6U3H5L2U4E12U3E7U3
E12R3U3R4H8U4E15R2"
112 DRAW"BM90,180;S3;A3;XF1$;BM9
0,180;S4;A0;XC1$;":PAINT(95,175)
,3,4:COLOR1,1:DRAW"BM90,180;S3;A
3;XF1$;BM90,180;S4;A0;XC1$;"
113 GOTO121
114 HX=108:HY=34:CIRCLE(HX,HY),2
,3:CIRCLE(110,30),13,4:LINE(240,
175)-(252,183),PSET,BF
115 CIRCLE(192,114),5,2:CIRCLE(2
10,124),5,2:CIRCLE(160,120),5,2:
CIRCLE(159,130),5,2:CIRCLE(150,1
23),5,2:CIRCLE(207,113),5,2
116 DRAW"BM140,64;S8;A2;XSM$;BM1
16,56;A3;XSM$;BM130,28;S4;XGR$;B
M88,41;A2;XGR$;":PAINT(120,68),2
,4:PAINT(156,58),2,4:PAINT(100,4
6),2,4:PAINT(132,34),2,4
117 COLOR1,1:DRAW"BM140,64;S8;A2
;XSM$;BM116,56;A3;XSM$;BM130,28;
S4;XGR$;BM88,41;A2;XGR$;BM190,12
4C3XSM$;":PAINT(196,122),3,3
118 GOTO121
119 HX=116:HY=94:CIRCLE(HX,HY),1
0,4:CIRCLE(HX,HY),2,3:LINE(150,1
28)-(158,136),PSET,BF
120 WC$="G4D2G2D2F2D3F2D2F3R3F2R
3E3R3E3R2E2U3E2U3H6U2L3U2L4H2L2G
4":DRAW"BM106,79;S6A0XWC$;":PAIN
T(108,86),3,4:COLOR1,1:DRAW"BM10
6,79;S6A0XWC$;"
121 CLS:OB=0:POKE1024,191:PRINT@
1,"COURSE YARDAGE = 7,088 YDS.":
POKE1056,191:PRINT@33,"COURSE PA
R = 72"
122 POKE1088,239:PRINT@65,"HOLE"
;HO;:POKE1097,239:PRINT@74,"PAR"
;PA(HO):POKE1105,239:PRINT@82,"L
ENGTH";LE(HO);"YDS"
123 POKE1120,175:PRINT@97,"WIND-
 SPEED";WS;"** DIRECTION ";WD$:P
OKE359,126:PRINT@128,SZ$;
124 PRINT@288,SZ$:PRINT@326,"AVE
RAGE DISTANCES";:PRINT@353,"WOOD
S: DR=265  3W=241";:PRINT@385,"I
RONS:  1=223   2=211   3=202";:P
RINT@425,"4=193   5=184   6=175"
;:PRINT@457,"7=166   8=157   9=1
48";:PRINT@482,"       10=133";
125 TG=0:IF RF<>.99 THENPRINT@17
9,CHR$(175);"YOU HAVE A":IF RF=1
 THENPRINT@212,"GOOD LIE":GOTO12
9
126 IF RF=.99THEN129ELSEIF RF>.7
 AND RF<1THENPRINT@212,"FAIR LIE
":GOTO129
127 IF RF>.5 AND RF<.8THENPRINT@
212,"BAD LIE";:GOTO129
128 PRINT@179,CHR$(191);"BAD LIE
   ":PRINT@212,"BE CAREFUL":TG=1
129 IF RF<>.99 THENPRINT@243,CHR
$(239);"DISTANCE TO":PRINT@276,"
HOLE";DH*4;"YDS";
130 A$=INKEY$:IF A$=""THENPRINT@
161,"WHICH CLUB**** ";:FOR T=1 T
O 20:NEXTT:POKE1198,127:FOR T=1
TO 80:NEXTT:GOTO130
131 IFA$=CHR$(83)THENSCREEN1,0:P
SET(SX,SY,3):FOR T=1 TO 50:NEXTT
:PSET(SX,SY,2):FOR T=1 TO 50:NEX
TT:B$=INKEY$:IF B$=""THEN131ELSE
SCREEN0,0:GOTO130
132 SOUND30,1:IF A$=CHR$(13)THEN
134ELSENN=NN+1:C$(NN)=A$:GOTO130
133 FOR T=1 TO 400:NEXTT:POKE123
2,32:GOTO130
134 FOR N=1 TO NN:C$=C$(1)+C$(2)
:NEXT N:PLAY"T230;O5AO4BO5F":PRI
NT@176,C$;:IF FL=1 THEN IF SS$="
D"THEN SS$="F"ELSEIF SS$="F"THEN
 SS$="D"
135 IFTG<>1THEN138ELSEIF C$="DR"
ORC$="3W"THENRF=.2-RF:GOTO138
136 C=VAL(C$):IF C<5THENRF=.3-RF
:GOTO138
137 IF C<10THENRF=.4-RF ELSERF=R
ND(4)+3:RF=RF/10
138 A$=INKEY$:IF A$=""THENPRINT@
193,"DIRECTION***** ";:FOR T=1 T
O 20:NEXTT:POKE1230,127:FOR T=1
TO 80:NEXTT:GOTO138
139 IF A$=CHR$(83)THENSCREEN1,0:
PSET(SX,SY,3):FOR T=1 TO 100:NEX
TT:PSET(SX,SY,2):B$=INKEY$:IF B$
=""THEN139ELSESCREEN0,0:GOTO138
140 SOUND30,1:IF A$=CHR$(13)THEN
141ELSE PR=PR+1:DR$(PR)=A$:GOTO1
38
141 FOR N=1 TO PR:DR$=DR$(1)+DR$
(2):NEXT N:PLAY"T230;O5AO4BO5F":
PRINT@208,DR$;
142 A$=INKEY$:IF A$=""THENPRINT@
225,"LENGTH OF ARC* ";:FOR T=1 T
O 20:NEXTT:POKE1262,127:FORT=1 T
O 80:NEXTT:GOTO142
143 IF A$=CHR$(83)THENSCREEN1,0:
PSET(SX,SY,3):FOR T=1 TO 50:NEXT
:PSET(SX,SY,2):FOR T=1 TO 50:NEX
T:B$=INKEY$:IF B$=""THEN143ELSES
CREEN0,0:GOTO142
144 IF A$>"7"OR A$<"2"THENSOUND1
```

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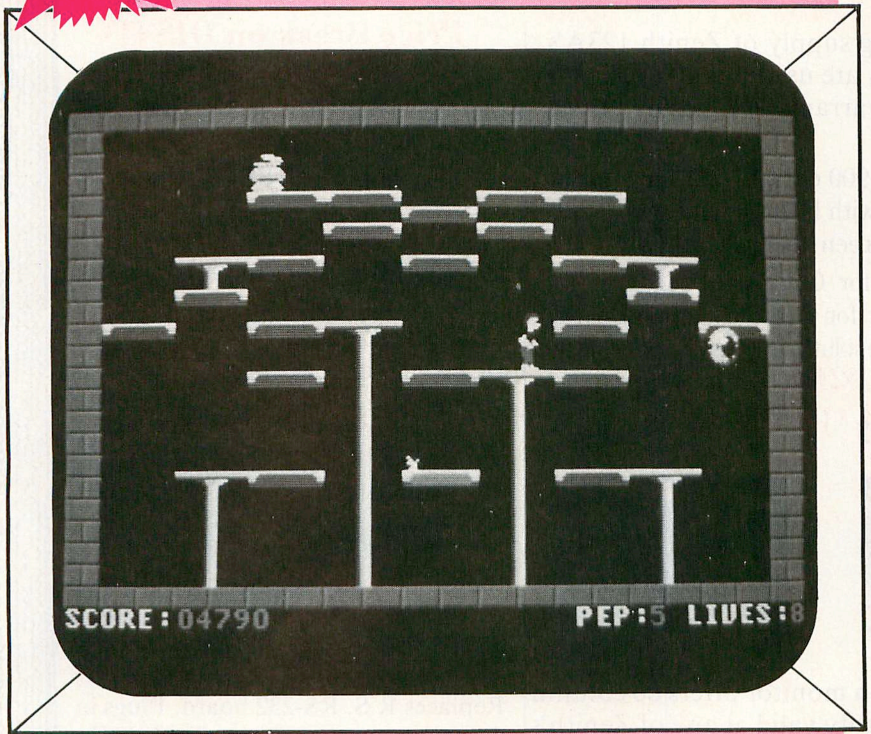

Rupert Rythym

by Nickolas Marentes

Help Rupert infiltrate "Music Box Records" and collect all of his stolen notes which are scattered throughout the complex. Ride the crazy elevators and beware of the security robots on patrol.

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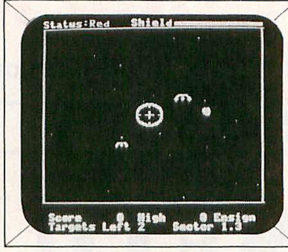

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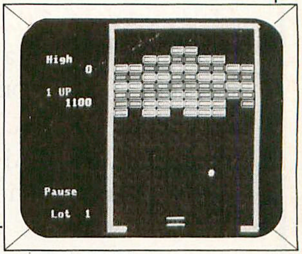

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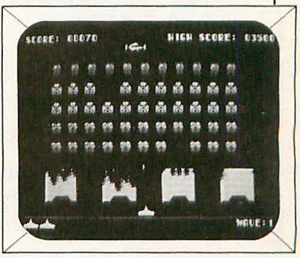

MINE RESCUE

by Steve Bjork

A terrible mine disaster has just occured and it will be up to you and your talents to enter the mine, jump the pits, avoid the spikes, fight off the bats and other creepy crawlers and get air to the needy victims. Mine rescue features over 2 megabytes of arcade-style graphics, real time music and multiple mine levels.

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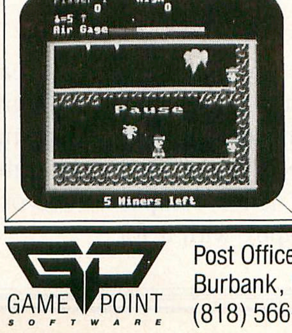

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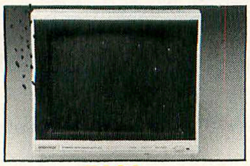

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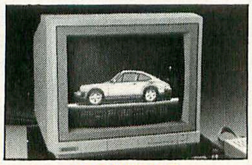

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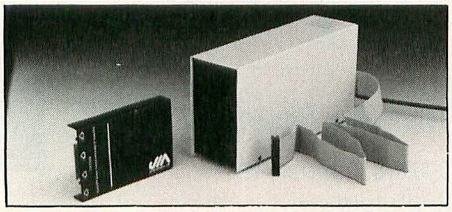

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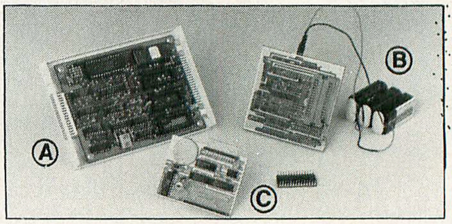

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```
,5:A$="":GOTO142
145 LA=VAL(A$):PLAY"T230;O5AO4BO
5F":PRINT@239,LA;:IF LA<5THENTS$
="":PRINT@257,"TYPE OF SHOT** ";
:PRINT@272,"*";:GOTO150
146 A$=INKEY$:IF A$=""THENPRINT@
257,"TYPE OF SHOT** ";:FOR T=1 T
O 20:NEXTT:POKE1294,127:FORT=1 T
O 80:NEXTT:GOTO146
147 IF A$=CHR$(83)THENSCREEN1,0:
B$=INKEY$:IF B$=""THEN147ELSESCR
EEN0,1:GOTO146
148 IF A$="F"OR A$="D"THEN149 EL
SE146
149 TS$=A$:PLAY"T230;O5AO4BO5F":
PRINT@272,TS$;
150 PRINT@320,BS$
151 PRINT@416,"*(PRESS <ENTER> T
O PLAY HOLE)":PRINT@448,"*(PRESS
 <SPACE BAR> TO CHANGE      ANY V
ALUES    ";
152 A$=INKEY$:IF A$=""GOTO152
153 IF A$=CHR$(13)THEN156
154 IF A$=CHR$(32)THENPRINT@176,
BL$;:PRINT@208,BL$;:PRINT@239,BL
$;:PRINT@271,BL$;:PR=0:NN=0:C$(1
)="":C$(2)="":DR$(1)="":DR$(2)="
":GOTO130
155 PRINT@271,BL$;:GOTO146
156 DR=VAL(DR$):IF INT(WD/2)=WD/
2THEN163
157 IF WD=1 OR WD=5 THEN158ELSE1
60
158 IF DR=0 OR DR=1 OR DR=23 THE
NIF WD=1 THENDW=-2*WS ELSEDW=2*W
S
159 IF DR>10 AND DR<14 THENIFWD=
5 THENDW=-2*WS ELSEDW=2*WS
160 IF WD=3 OR WD=7 THEN161ELSE1
63
161 IF DR>4 AND DR<8 THENIFWD=3
THENDW=-2*WS ELSEDW=2*WS
162 IF DR>16 AND DR<20 THENIFWD=
7 THENDW=-2*WS ELSEDW=2*WS
163 IF WD=2 OR WD=6 THEN164 ELSE
166
164 IF DR>1 AND DR<5 THENIFWD=2
THENDW=-2*WS ELSEDW=2*WS
165 IF DR>13 AND DR<17 THENIFWD=
6 THENDW=-2*WS ELSEDW=2*WS
166 IF WD=4 OR WD=8 THEN167 ELSE
167 IF DR>7 AND DR<11 THENIFWD=4
 THENDW=-2*WS ELSEDW=2*WS
168 IF DR>19 AND DR<23 THENIFWD=
```

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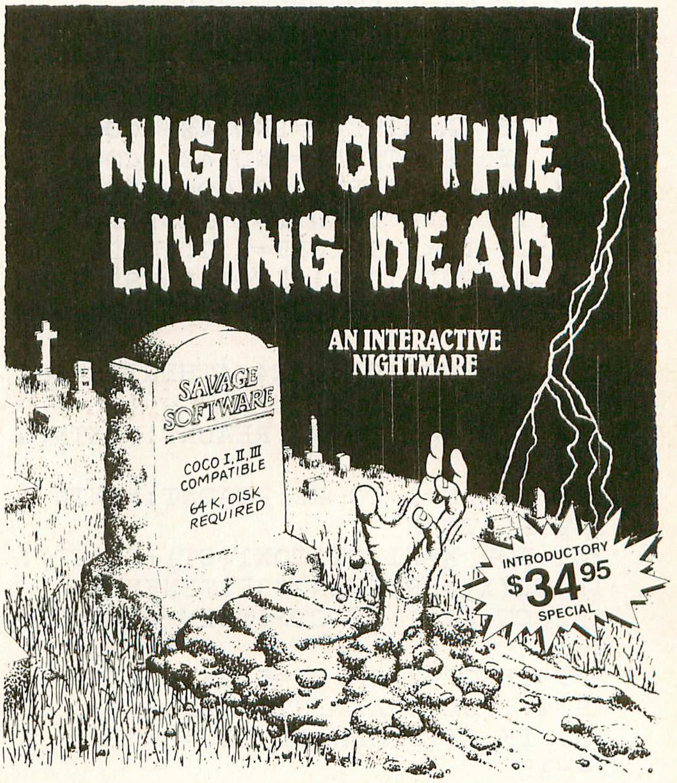

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```
8 THENDW=-2*WS ELSEDW=2*WS
169 IN(1)=5:IN(2)=4:IN(3)=5:IN(4
)=5:IN(5)=4:IN(6)=5
170 IF WD=1THENX1(1)=2:X1(2)=5:X
1(3)=14:X1(4)=17
171 IF WD=2THENX1(1)=5:X1(2)=8:X
1(3)=17:X1(4)=20
172 IF WD=3THENX1(1)=8:X1(2)=11:
X1(3)=20:X1(4)=23
173 IF WD=4THENX1(1)=11:X1(2)=14
:X1(3)=23:X1(4)=2
174 IF WD=5THENX1(1)=14:X1(2)=17
:X1(3)=2:X1(4)=5
175 IF WD=6THENX1(1)=17:X1(2)=20
:X1(3)=5:X1(4)=8
176 IF WD=7THENX1(1)=20:X1(2)=23
:X1(3)=8:X1(4)=11
177 IF WD=8THENX1(1)=23:X1(2)=2:
X1(3)=11:X1(4)=14
178 IF C$="DR"THENCC=460:IF ST>0
 THENGF=(RND(5)+5)/10
179 IF C$="3W"THENCC=410
180 IF C$="1"THENCC=380
181 IF C$="2"THENCC=360
182 IF C$="3"THENCC=345
183 IF C$="4"THENCC=330
184 IF C$="5"THENCC=315
185 IF C$="6"THENCC=300
186 IF C$="7"THENCC=285
187 IF C$="8"THENCC=270
188 IF C$="9"THENCC=255
189 IF C$="10"THENCC=230
190 IF LA=7THENR=RND(100):CO=-R
191 IF LA=6THENR=RND(40):CO=R-25
192 IF LA=5THENR=RND(40):CO=R
193 IF LA<5THENR=20:CO=-(R)
194 IF LA>4 THENLF=1 ELSELF=.1
195 IF LA<5 THENNT=0:GOTO229
196 R1=RND(13)+1:IF TS$=SS$ THEN
R2=RND(9)+15:R3=RND(3):IF R3<>3T
HEN199
197 R4=RND(10):IFR4<4THENTS$=SS$
:GOTO199
198 FOR N=1 TO R1:READNT:NEXTN:G
OTO200
199 FOR N=1 TO R2:READNT:NEXTN
200 RESTORE
201 FOR X=X1(CT)TOX1(CT)+IN(CT):
IF WD(X)=DR THEN203ELSENEXTX
202 CT=CT+1:IF CT>6THEN CT=0ELSE
201
203 IF CT=2 OR CT=5 THEN AF=INT(
WS/4.1)ELSE AF=INT(WS/12+.3)
204 IF CT>3THEN IF TS$="F"THEN A
F=-AF
205 IF CT=0 THEN206ELSEIF CT>0 A
ND CT<4 THEN IF TS$="D"THEN AF=-
AF
206 CT=1:NT=INT(NT*LA/10*1.92+AF
)
207 IF NT<0THEN FL=1:IF TS$="D"T
HEN TS$="F"ELSE IF TS$="F"THEN T
S$="D"
208 NT=ABS(NT):AF=0:C=VAL(C$)
209 IF C>6 AND C<11 THENIF NT>1
THEN NT=1
210 IF C>3 AND C<7 THENIFNT>2 TH
ENNT=2
211 IF C>0 AND C<4 THENIF NT>3 T
HEN NT=3
212 IF TS$="F"THEN 221
213 IF INT(DR/2)<>DR/2THEN217
214 IFDR=0 OR DR=2 OR DR=12 OR D
R=16THENXC=3:YC=6:GOTO229
215 IFDR=4 OR DR=10 OR DR=16 OR
DR=22THENXC=6:YC=6:GOTO229
216 IFDR=6 OR DR=8 OR DR=18 OR D
R=20THENXC=8:YC=2:GOTO229
217 IFDR=1 OR DR=13THENXC=0:YC=9
:GOTO229
218 IFDR=3 OR DR=11 OR DR=17 OR
DR=23THENXC=4:YC=7:GOTO229
219 IFDR=5 OR DR=9 OR DR=15 OR D
R=21THENXC=7:YC=4:GOTO229
220 IFDR=7 OR DR=19THENXC=8:YC=0
:GOTO229
221 IF INT(DR/2)<>DR/2THEN225
222 IFDR=0 OR DR=10 OR DR=12 OR
DR=22THENXC=2:YC=8:GOTO229
223 IFDR=2 OR DR=8 OR DR=14 OR D
R=20THENXC=6:YC=6:GOTO229
224 IFDR=4 OR DR=6 OR DR=16 OR D
R=18THENXC=8:YC=2:GOTO229
225 IFDR=1 OR DR=9 OR DR=15 OR D
R=21THENXC=4:YC=7:GOTO229
226 IFDR=3 OR DR=7 OR DR=13 OR D
R=19THENXC=7:YC=4:GOTO229
227 IFDR=5 OR DR=17THENXC=8:YC=0
:GOTO229
228 IFDR=11 OR DR=23THENXC=0:YC=
9
229 IF INT(DR/2)=DR/2 THEN233
230 IF DR=5 OR DR=7 OR DR=17 OR
DR=19THENXI=10:YI=2.34:GOTO237
231 IF DR=3 OR DR=9 OR DR=15 OR
DR=21THENXI=4.34:YI=4.345:GOTO23
7
232 IF DR=1 OR DR=11 OR DR=13 OR
 DR=23THENXI=1.34:YI=5.34:GOTO23
7
233 IF DR=0 OR DR=12THENXI=0:YI=
5.34:GOTO237
234 IF DR=6 OR DR=18 THENXI=11:Y
I=0:GOTO237
235 IF DR=2 OR DR=10 OR DR=14 OR
 DR=22THENXI=3:YI=5.26:GOTO237
236 IF DR=4 OR DR=8 OR DR=16 OR
DR=20 THENXI=7:YI=3.34
```

Announcing a Great New Floppy Drive System for the Color Computer:

The New OWL-Ware Floppy Drive System

No Better System is Available at Any Price (But the Price is Great, too!)
Two New Products First Shown at Rainbowfest, Princeton 1988

DISK CONTROLLER

We at OWL-WARE are pleased to announce that we have purchased the rights to all of the Color Computer Products of J&M Systems. J&M has had more experience with CoCo controllers than any other supplier (except for Radio Shack® itself) and we are proud to add them to our nest! OWL-WARE will now be producing J&M controllers under the OWL brand. These controllers all use J&M's proven designs, with some minor improvements, and they will serve you for years to come.

- All gold contacts
- Works with all CoCo models (1,2,3)
- Holds 2 switchable ROMS
- Positive switching by simple jumper or optional external switch (No erratic software or pokes required)
- Buffered I/O lines to help prevent burn-out if unit accidentally pulled out with the system on
- Latching chips are socketed to speed repairs
- Does not use the WD1773 chip which caused problems with many CoCo 3 systems and is now discontinued
- Attractive all metal case
- Dealer inquiries now invited

CONTROLLER only $69.
(without ROMs)

(Add $14.95 for RSDOS
$19.95 RSDOS and OWLDOS)

See the next 2 pages for more drive and software specials from OWL-WARE

COMPUTER
CAUTION
TURN OFF POWER BEFORE
REMOVING OR INSERTING
OWL CONTROLLER
DISC DRIVE
OWL
DRIVE SYSTEM

Disk drives are not our only business, but they sure are our main business! We have been selling hard and floppy drives for the CoCo longer than any other Rainbow advertiser. **Our double sided drives are brand new, half-heights with a full one year warranty!** The full-height drives offered cheap by our competition are *used or surplus!*

NEW! Keyboard Interface for the CoCo!

At last you can type on a real IBM® type professional computer keyboard. You can use the keyboard in your lap or a comfortable table and/or 6 to 12 feet from the CoCo. This interface allows the use of both user programmable function keys and programmed "quick keys". The cursor pad and the number keypad function like an IBM®. An on board ROM provides for different programmed keys for BASIC and OS-9. Easy to install and no soldering is required. Probably the most useful and pleasant addition to your CoCo and is much better than any keyboard extension or add-on keyboard. Includes easy to follow instructions. Use with any standard IBM® style keyboard or use ours.

Interface $119. **101-Key Keyboard only $45.**

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In recent months it has become very difficult to obtain dependable, safe power supply and cases for floppy drive systems. They just couldn't pass our quality control. OWL-WARE has now produced a case and power supply that you can be proud to own and use. We believe that this is the best and most attractive drive case available for any computer.

- Built in surge protector! (we believe that this feature is unique in CoCo drive cases)
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- Heavy-duty power supply
- Fully shielded data cable
- Modular power supply construction for ease of repairs
- Stackable case design
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On the Razor's Edge of

Basic and OS-9 Hard Drive Systems

Proven Performance for Demanding Home or Business Users

Every hard drive which has been produced by OWL-WARE during the last 3 years is **complete**. A system consists of software, hard drive, controller, heavy-duty power supply, and LR Tech Interface. There are no hidden costs for assembly or testing. When a drive system is ordered, we fully **assemble**, **test**, and **burn-in** the system for 3 full days. This ensures dependability and optimum performance.

We have now been supplying CoCo hard drive systems and parts for more than 3 years. This is the longest history in the CoCo market of any system. Some other advertisers are stating that they have one of the most reliable systems for the CoCo *with all of 4 months history in the CoCo hard drive market*! We have reached our position in the hard drive market by providing our customers with a quality product that they (and we) can be proud to own and use.

Because of many requests for a lower price system in kit form, we are now selling a kit of all parts at a significant discount compared to our regular prices. We recommend this kit (or any kits offered by any other supplier) only to those who have experience in electronic assembly and OS-9.

We have **LR Tech** and **Burke & Burke**

For OS-9 Levels 1 and 2

	10 Meg.	20 Meg.	40 Meg.	80 Meg. (2 X 40 Meg.)
System Prices: (Includes Hard Drive, Controller, LR Tech Interface, Software. Fully assembled and tested.)	$469.	$599.	$725.	$1,069.
Kit Prices: (LR Tech System as above but not assembled or tested.)	$419.	$549.	$659.	$ 999.
Kit Prices: (As above but using Burke & Burke bus adapter)	(na)	$489.	$609.	(lower prices)

30 Meg Kit: $539. (Lowest prices anywhere)

OWL Hard Drive BASIC 3

There have been several ads in this magazine about BASIC for Color Computer hard drive systems. These ads sometimes only tell a part of the story. Our BASIC system price includes **assembly**, **testing**, and **3-day burn-in** period. We do not require a Multi-pak to operate.

Our hard drive systems are fast, reliable, and reasonable in price. This has been proven by hundreds of users over the past 3 years. We do not have to turn off error checking for speed. We achieve high speed BASIC from a unique indexing method.

The table below will summarize some of the key points about our BASIC hard drive system and the B&B system. We believe that we have the best BASIC interface for CoCo hard drives available.

BASIC Hard Drive Systems*

Feature	OWL	B&B
Drive Portion Available at One Time	Entire	Partial (4 sections)
User Sets BASIC/OS-9 Partitions	YES	Yes
Add to Existing OS-9 Drive Without Reformat	YES	No(?)
Drives 0-3 Hard/Floppy	YES	No
Built in Park	YES	No
Speed*	FAST	Fast

*All feature details are believed to be true at time of writing and are subject to change. We believe that our BASIC hard drives are the fastest due to our indexing method, but both systems are fast and we sell both. On ours all BASIC commands work including DSKINI, DSKI$, and DSKO$.

Prices: With/Without Hard Drive

$35./$79.

Technology

the Color Computer Frontier

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Disk Drive
Purchase!

Floppy Drive Systems

The Highest Quality for Years of Service

(We have located a number of unused, surplus single sided drives for those who wish a quality, inexpensive system.)

Drive 0 Systems (Half Height, Double Sided, Direct Drives) $199. (Same but Single sided) $185

Drive 0 systems complete with drive, controller, legal DOS, cable, case, power supply, and manual

Drive 1 Systems (Half Height, Double Sided, Direct Drives) $129. (Same but Single sided) $115.

New 3.5", 720K Drives for OS-9 with case & Power Supply $179.

Drive 1 Systems have drive, case, power supply. (You may require optional cable and/or DOS chip to use)

Special for 0/1 Combos (Drives 0,1,2,3) $295.

HALF-HEIGHT DRIVE UPGRADES FOR RS HORIZONTAL CASES

Why only double the capacity of your system when you can triple in the same case? Kit includes: double-sided to fit your case, chip to run both sides of new drive, hardware, and detailed instructions. Easy! Takes only 5 minutes!

Model $119. 500 **Model $129.** 501 or 502

All drives are new and fully assembled. We ship only FULLY TESTED and CERTIFIED at these low prices. We use Fuji, YE Data, and other fine brands. No drives are used or surplus unless otherwise stated to you when you order. We appear to be the one of the few advertisers in Rainbow who can truly make this claim. We have 5 years experience in the CoCo disk drive market! We are able to provide support when you have a problem.

Drives 1 Year Warranty

OWL Phones

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1-215-682-6855

Technical Help
1-215-837-1917

OWL WARE Software Bundle

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DISK TUTOR Ver 1.1

Learn how to use your disk drive from this multi-lesson, machine language program. This tutor takes you through your lessons and corrects your mistakes for a quick, painless disk drive introduction. (This professionally written tutor is easily worth the bundle's total price.)

OWL DOS

An operating system that gives faster disk access and allows the use of double-sided drives. Corrects a floating point number error on early CoCo systems.

COPY-IT

Quickly copies selected programs between disks. A wild card option selects groups of programs to copy.

VERIFY

Verifies reading of each sector. Bad sectors are listed on the screen.

2 GAMES

We will select 2 games from our stock. These sold for more than $20 each.

If sold separately this is more than $125 worth of software!!

Do not mistake this software with cheap, non-professional "Public Domain" software which is being offered by others. All of this software is copyrighted and professional in quality. The tutor is unique with us and has helped thousands of new users learn their disk drive.

only $27.95
(or even better)
only $6.95 with
any Disk Drive Purchase!!

Our prices include a discount for cash but do not include shipping.

OWL-WARE has a liberal warranty policy. During the warranty period, all defective items will be repaired or replaced at our option at no cost to the buyer except for shipping costs. Call our tech number for return. Return of non-defective or unauthorized returns are subject to a service charge.

OWL-WARE
P.O. BOX 116
Mertztown, PA 19539

```
237 PRINT@176,BL$;:PRINT@208,BL$
;:PRINT@239,BL$;:PRINT@271,BL$;:
PRINT@416,BS$;:PMODE3,1:SCREEN1,
0:DI=INT(CC*LA/10*RF*GF+(DW*LF))
+CO
238 RF=1:GF=1
239 AC=INT(AC*LA/10*1.3+.5):PP=D
I/22:FP=PP-INT(PP):PP=INT(PP+.5)
240 IF FT=1THENGOTO260
241 IF HO=1THENSX=18:SY=161:BX=S
X:BY=SY
242 IF HO=2THENSX=38:SY=45:BX=SX
:BY=SY
243 IFHO=3THENSX=236:SY=142:BX=S
X:BY=SY
244 IFHO=4THEN SX=57:SY=103:BX=S
X:BY=SY
245 IFHO=5THEN SX=145:SY=153:BX=
SX:BY=SY
246 IFHO=6THEN SX=204:SY=43:BX=S
X:BY=SY
247 IFHO=7THEN SX=56:SY=132:BX=S
X:BY=SY
248 IF HO=8THEN SX=174:SY=60:BX=
SX:BY=SY
249 IFHO=9THEN SX=174:SY=46:BX=S
X:BY=SY
250 IFHO=10THEN SX=145:SY=150:BX
=SX:BY=SY
251 IFHO=11THEN SX=20:SY=78:BX=S
X:BY=SY
252 IFHO=12THEN SX=178:SY=132:BX
=SX:BY=SY
253 IFHO=13THEN SX=126:SY=50:BX=
SX:BY=SY
254 IFHO=14THEN SX=145:SY=47:BX=
SX:BY=SY
255 IFHO=15THEN SX=128:SY=68:BX=
SX:BY=SY
256 IFHO=16THENSX=104:SY=45:BX=S
X:BY=SY
257 IFHO=17THENSX=246:SY=179:BX=
SX:BY=SY
258 IFHO=18THENSX=155:SY=131:BX=
SX:BY=SY
259 IF FT=0THENFT=1:RETURN
260 IF DR>-1 AND DR<7 THEN QX=1:
QY=-1:GOTO264
261 IF DR>6 AND DR<13 THEN QX=1:
QY=1:GOTO264
262 IF DR>12 AND DR<19 THEN QX=-
1:QY=1:GOTO264
263 IF DR>18 AND DR<24 THEN QX=-
1:QY=-1
264 RX=SX:RY=SY:IY=YI-INT(YI):IX
=XI-INT(XI)
265 FOR T=1 TO 300:NEXT T:CX=PP-
NT:CX=PP-NT:TS(ST)=DI:PLAY"T100V
31O4AB":PSET(SX,SY,1):PSET(BX,BY
,4)
266 FOR N=1 TO PP:CX=CX-1:IF CX<
0THEN SX=SX+XC*QX:SY=SY+YC*QY
267 IF CX>=0 THEN SX=SX+(INT(XI+
IX+TX)*QX):TX=TX+IX:IF TX>1THENT
X=0
268 IF CX>=0 THENSY=SY+(INT(YI+I
Y+TY)*QY):TY=IY+TY:IF TY>.66THEN
TY=0
269 IF SX<0 OR SX>255 OR SY<0 OR
 SY>191 THENSOUND1,5:CLS:PRINT@1
97,"****OUT OF BOUNDS****":FOR T
=1 TO 900:NEXTT:OB=1:PS=PS+1:SX=
RX:SY=RY:C$(1)="":C$(2)="":DR$(1
)="":DR$(2)="":NN=0:PR=0:IF ST=0
THENSX=BX:SY=BY:ST=ST+1:GOTO284:
ELSE284
270 IF PPOINT(SX,SY)=2THENPSET(S
X,SY):FOR T=1 TO80:NEXT T:PSET(S
X,SY,2):NEXT N:TR(HO)=TR(HO)+1:R
F=RND(9):RF=RF/10:GOTO293
271 IFPPOINT(SX,SY)=3THENPSET(SX
,SY,2):FORT=1 TO80:NEXTT:PSET(SX
,SY,3):NEXTN:IFABS(HX-SX)<5 AND
ABS(HY-SY)<5 THEN273ELSEPLAY"T20
0O1ABO4CDO1EF":PS=PS+1:TW=TW+1:W
H=WH+1:CIRCLE(SX,SY),3,2:FORT=1
TO 300:NEXTT:CIRCLE(SX,SY),3,3:G
OTO290
272 PSET(SX,SY):FOR T=1 TO 60:NE
XT T:PRESET(SX,SY):NEXT N
273 PSET(SX,SY,2)
274 RF=RND(100):IF RF>92 THENRF=
.8 ELSE IF RF<4 THENRF=.6 ELSERF
=1
275 IF SX<HX THENSP=1ELSESP=-1
276 IF SY<HY THENSE=1ELSESE=-1
277 IF SX>HX+18 THENCX=HX+20:GOT
O280
278 IF SX<HX-18 THENCX=HX-20:GOT
O280
279 CX=SX
280 IF SY>HY+18 THENCY=HY+20:GOT
O283
281 IF SY<HY-18 THENCY=HY-20:GOT
O283
282 CY=SY
283 FOR NX=CX TO HX STEPSP:FOR N
Y=CY TO HY STEP SE:IF PPOINT(NX,
NY)=4 THEN FG=1 ELSE NEXT NY,NX:
FG=0
284 DD=0:LX=ABS(SX-HX):LY=ABS(SY
-HY):DH=INT(SQR(LX^2+LY^2)):DX=A
BS(BX-SX)/2:DY=ABS(BY-SY):DD=INT
(SQR(DX^2+DY^2)):DD=INT(DD*4+.5)
:TS(ST)=DD
285 LX=ABS(SX-HX):LY=ABS(SY-HY):
LX=LX/2:DH=INT(SQR(LX^2+LY^2)):I
F OB=1 THEN121
286 CIRCLE(SX,SY),1,4:ST=ST+1
287 A$=INKEY$:CIRCLE(SX,SY),1,2:
FOR T=1 TO 50:NEXT T:CIRCLE(SX,S
Y),1,3:IF A$<>CHR$(83)THEN287ELS
```

```
EPR=0:DD=0:NN=0:C$(1)="":C$(2)="
":DR$(1)="":DR$(2)="":PRINT@180,
"     ";:PRINT@212,"
   ";:PRINT@244,"        ";:PR
INT@276,"          ";
288 SCREEN0,0:IF FG=0 THENCLS:LP
=DH:GOTO295
289 GOTO124
290 IF ST=0 THENS1(HO)=1
291 IF CX>=0 THENSX=SX-XI*QX:SY=
SY-YI*QY:IF PPOINT(SX,SY)<>3 AND
 (ABS(HX-SX)>11 OR ABS(HY-SY)>11
) THEN294 ELSE291
292 SX=SX-XC*QX:SY=SY-YC/2*QY:IF
 PPOINT(SX,SY)<>3 AND PPOINT(SX,
SY)<>2 AND (ABS(HX-SX)>11 OR ABS
(HY-SY)>11) THEN294ELSE CX=CX+1:
GOTO291
293 IF ST=0THENS1(HO)=1
294 GOTO275
295 DW=0:PS(HO)=PS:PG=RND(100):S
T(HO)=ST
296 IF PG>22 AND PG<28 THEN NP=1
:GOTO305
297 IF DH>10 AND PG>50 AND PG<54
 THENNP=4
298 IF DH=0 THENPLAY"T8O5GBDO3FA
CO5CEG":SCREEN0,1:CLS:PRINT@102,
"YOU HOLED OUT!":FOR T=1 TO 600:
NEXTT:GOTO305
299 IF DH>0 AND DH<3 THEN IF PG>
9 THENNP=1 ELSENP=2:GOTO305
300 IF DH>2 AND DH<5 THEN IF PG>
49 THENNP=1 ELSENP=2:GOTO305
301 IF DH>4 AND DH<7 THEN IF PG>
69 THENNP=1 ELSENP=2:GOTO305
302 IF DH>6 AND DH<9 THEN IF PG>
29 THENNP=2 ELSENP=1:GOTO305
303 IF DH>8 AND DH<11 THEN IF PG
>49 THENNP=2 ELSENP=3:GOTO305
304 IF DH >10 THEN IF PG>69 THEN
NP=2 ELSENP=3:GOTO305
305 NP(HO)=NP:SC(HO)=ST+NP+PS:PT
=PT+NP
306 SCREEN0,0:CLS:PRINT@7,"STATS
 FOR HOLE ";HO;:PRINT@33,"PAR ";
PA(HO);"   LENGTH OF HOLE ";LE
(HO);:PRINT@64,SZ$;
307 PRINT@97,"PENALTY STROKES***
*********";PS:XP=XP+PS:PRINT@129
,"SCORE FOR THE HOLE*********";S
C(HO);:PRINT@160,SZ$;
308 IF HO=4 OR HO=8 OR HO=15 OR
HO=18 THENPRINT@225,"DRIVE LAND
IN FAIRWAY?***** --";:GOTO310
309 TL=TL+TS(0):PRINT@225,"DRIVE
 LAND IN FAIRWAY?***** ";:IF S1(
HO)=1 THENPRINT"NO"ELSEPRINT"YES
";:GD=GD+1
310 PRINT@193,"LENGTH OF TEE SHO
T*********";TS(0);
```

The RAINBOW

THE COLOR COMPUTER MONTHLY MAGAZINE

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For greater convenience, order RAINBOW Back Issues through the Rainbow Magazine Services area of our Delphi CoCo SIG.

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Due to heavy demand, we suggest you order the back issues you want now while supplies last.

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```
311 PRINT@257,"# OF TIMES IN ROU
GH/TRAP***";TR(HO);:BR=BR+TR(HO)
:PRINT@289,"# OF TIMES IN WATER*
******";WH;:PRINT@320,SZ$;:PRIN
T@353,"REACHED GREEN IN REGULATI
ON ";:IF ST+PS<=PA(HO)-2 THENPRI
NT"YES":GR=GR+1ELSEPRINT"NO";
312 PRINT@385,"NUMBER OF PUTTS**
*********";NP;
313 IF HO<10 THENYF=YF+SC(HO)ELS
EYB=YB+SC(HO)
314 A$=INKEY$:IF A$=""THEN314ELS
EST=0:YS=YF+YB:CLS
315 PRINT@9,"***SCORECARD***":PR
INT@64,"HOLE PAR SCR   HOLE P
AR SCR";:FH=96:BH=113:FP=102:FS=
106:BP=119:BS=123
316 FOR X=1 TO 9:PRINT@FH,X:FH=F
H+32:PRINT@FP,PA(X):FP=FP+32:PRI
NT@FS,SC(X):FS=FS+32:NEXTX:PRINT
@384,"TOTAL  36 ";YF;
317 FOR X=10 TO 18:PRINT@BH,X:BH
=BH+32:PRINT@BP,PA(X):BP=BP+32:P
RINT@BS,SC(X):BS=BS+32:NEXTX:PRI
NT@401,"TOTAL  36 ";YB;
318 TP=TP+PA(HO):SR=YS-TP:IF SR<
0 THENPOKEPV,ABS(SR)+48 ELSEIF S
R=0 THENPRINT@RP," E";ELSEPRINT@
RP,SR;
319 IF HO=9 THENRP=93:PV=1118
320 RP=RP+32:PV=PV+32
321 A$=INKEY$:IF A$=""THEN321ELS
EIF HO=18 THEN322 ELSEHO=HO+1:PS
=0:NP=0:WH=0:GOTO23
322 CLS:PD=PEEK(&HC000):IF PD<>6
8THEN326ELSEINPUT"DO YOU WANT  T
O SAVE YOUR STATS TO DISKETTE Y/
N";F1$:IF F1$="N"THEN325ELSEPRIN
T:INPUT"MAKE SURE YOUR DRIVE IS
ON AND  A DISK IS IN IT....PRESS
 RETURN WHEN READY";F2$
323 INPUT"IS THIS YOUR FIRST SAV
E OF THIS FILE Y/N";F3$:IF F3$="
N"THEN324ELSEZS=85:ZD=6:ZL=245:Z
G=6:ZP=36:ZG=10:ZW=8:ZX=10:OPEN"
O",#1,"FINLSTAT/DAT":WRITE#1,ZS,
ZD,ZL,ZG,ZP,ZR,ZW,ZX:CLOSE#1:GOT
O325
324 OPEN"I",#1,"FINLSTAT/DAT":IN
PUT#1,ZS,ZD,ZL,ZG,ZP,ZR,ZW,ZX:CL
OSE#1
325 CLS
326 PRINT@10,"FINAL STATS":PRINT
@65,"SCORE**********************
";YS;:PRINT@97,"# OF DRIVES IN F
AIRWAY*****";GD;:PRINT@129,"AVER
AGE LENGTH OF DRIVE****";INT(TL/
14);:PRINT@161,"GREENS REACHED R
EGULATION**";GR;:PRINT@193,"# OF
 PUTTS*****************";PT;
327 PRINT@225,"# OF TIMES IN ROU
```

```
GH / TRAPS";BR;:PRINT@257,"# OF
TIMES IN WATER********";TW;:PRIN
T@289,"PENALTY STROKES**********
**";XP
328 FOR T=1 TO 600:NEXTT:IFMT=3T
HEN340
329 IF F1$="N"OR PD<>68 THEN340E
LSEPRINT@352,"**FLASHING ASTERIS
KS=NEW RECORD"
330 IF YS<ZS THENPRINT@93,"**";:
IFMT=2 THENZS=YS
331 IF GD>ZD THENPRINT@125,"**";
:IFMT=2 THENZD=GD
332 IF INT(TL/14)>ZL THENPRINT@1
57,"** ";:IFMT=2 THENZL=INT(TL/1
4)
333 IF GR>ZG THENPRINT@189,"**";
:IFMT=2 THENZG=GR
334 IF PT<ZP THENPRINT@221,"**";
:IFMT=2 THENZP=PT
335 IF BR<ZR THENPRINT@253,"**";
:IFMT=2 THENZR=BR
336 IF TW<ZW THENPRINT@285,"**";
:IFMT=2 THENZW=TW
337 IF XP<ZX THENPRINT@317,"**";
:IFMT=2 THENZX=XP
338 FOR T=1 TO 200:NEXTT
339 PRINT@352,"  ";
340 IF F1$="Y"THENMT=MT+1:IF MT<
4THEN326ELSEOPEN"O",#1,"FINLSTAT
/DAT":WRITE#1,ZS,ZD,ZL,ZG,ZP,ZR,
ZW,ZX:CLOSE#1
341 PRINT:PRINT:INPUT"PLAY AGAIN
 Y/N";F4$:IF F4$="Y"THENRUN0ELSE
END
342 XB=1216:YY=1247:X=480:CLS:A$
=STRING$(32,32):T1$="         SC
RATCH GOLFER":N$="         LARRY
 DUGGINS"
343 PRINT@X,T1$:X=X-32:IFX>193TH
ENFORT=1 TO 30:NEXT:PLAY"T100;A"
:GOTO343
344 X=480
345 PRINT@X,A$:X=X-32:IFX>129THE
NFORT=1 TO 30:NEXT:PLAY"T160;O2A
":GOTO345
346 FORT=1 TO 100:NEXT
347 FOR L=1 TO 16:PLAY"T190O5AED
":POKEXB-1,96:POKEYY+1,96:FORT=1
 TO 30:NEXT:POKEXB,66:POKEYY,89:
XB=XB+1:YY=YY-1:NEXT
348 PLAY"T200":FORFT=1TO20:PLAY"
T+CE":NEXTFT:PRINT@256,N$
349 FORT=1 TO 800:NEXT:RETURN
```

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The RAINBOW, July 1987

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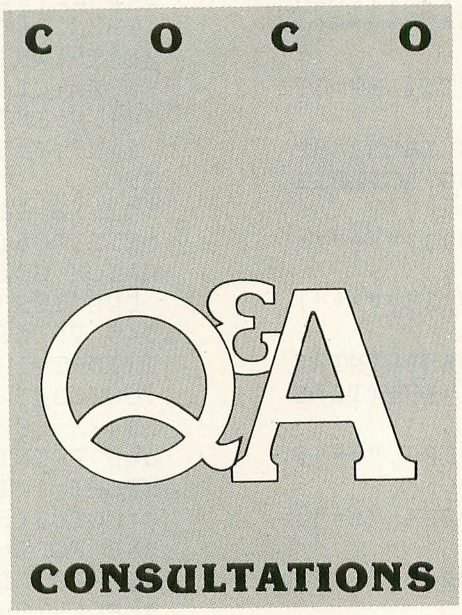

By Marty Goodman
Rainbow Contributing Editor

Hacking Is Required

I am about to release Extended ADOS, which will offer numerous added features including a Disk BASIC*-compatible RAM disk. However, it requires that users burn it into a 27128 (16K) EPROM. I know the shortie controller for the FD 502 drive from Tandy has a 28-pin socket in it, but can one drop a 27128 EPROM into that socket and have it work? Or is some hardware hacking needed?*

Art Flexser
(ARTFLEXSER)
Spectro Systems
Miami, Florida

Tandy insisted on wiring that socket so it only accepts 2764 chips. This is a shame because it could have been wired to accept both 2764 and 27128 chips without jumper changes. To fix the FD 502 controller to accept 27128 EPROMs, you must open the controller (voiding the warranty) and remove the printed circuit board. Remove the ground plane from the bottom of the board. Now look carefully at the 28-pin ROM socket. You'll note that pins 28, 27 and 26 are tied to each other with a trace on the solder side of the socket. You need to cut the trace joining Pin 26 to pins 27 and 28. Then jumper Pin 28 to the A13 contact on the 40-pin edge connector, which plugs into the CoCo or Multi-Pak Interface. If you look at the disk controller's top (component side) with the edge connector pointing up, Pin 37 is the second pin from the left.

Definite Differences

Can I use an FD 502 drive with a Commodore 64?

Brett Stafford
Franklinton, Louisiana

No. The Commodore uses a unique arrangement for talking to its disk drives and requires special logic boards for the drives. The CoCo uses industry-standard disk drives, like those used in PC compatibles and many older CP/M machines. You can't even read a disk written by a Commodore 64 using a normal (CoCo or IBM) disk drive. It is physically impossible.

Transfer Trouble

How can I transfer a binary file from a CoCo to an IBM PC, so I can burn it into an EPROM? I have access to an IBM PC with an EPROM burner and want to use it to burn a file I created and saved to disk on my CoCo.

Steve Imlay
(SIMLAY)
St. Joseph, Missouri

While possible, what you want to do is fraught with problems due to idiosyncrasies of the file structures of the CoCo and the IBM PC. Generally when you are saving binary data to disk on a CoCo (especially via BASIC), you are actually creating a binary program file. This file contains not only the data you are saving, but also an extra 10 bytes (five at the start and five at the end) of system information telling the CoCo where to put the file and where to execute it. You can bring such a file over to the IBM using a null modem cable, *CoCo Util*, or even MS-DOS-to-CoCo transfer programs. But you need to snip off the first and last five bytes of the file once it arrives on the IBM and before you burn it into an EPROM. I suggest you snip off the first five bytes first, retain as many bytes as you know the file should have, then discard everything following that. Some file transfer situations, like Xmodem and my transfer program, append garbage to the end of files they bring over.

Your question reminds me of an amusing situation where a well-known CoCo author tried to get a company he was working for to burn a CoCo ROM. He sent it an ML program file with multiple segments for the data. Such files (generated by the output of assemblers on the CoCo) are more difficult for other systems than a mere ML save from BASIC because they have not two, but many sets of five system bytes located at the ends of the file and scattered throughout it. Needless to say, the people at the company could not use the file as presented. But it took the CoCo author some time to realize his mistake.

No Software Solution

How can I put the game Rad Warrior *onto my disk drive? I don't want to damage my system by plugging and unplugging the cartridge and my disk controller.*

JD Cleveland
(JDCLEVELAND)
Lundberg, Nova Scotia
and Gabriel Paradis
Matapedia, Quebec

The new 32K ROM packs are very difficult to put onto disk, and none of the old ROM pack-to-disk utilities are capable of dealing with them. Even packs that were not *specifically* constructed to be difficult to transfer to disk (like *Rad Warrior* and *Silpheed*) are tricky because of the 32K-ROM and 128K-RAM environment of the CoCo 3. ROM packs like *Pitfall II*, whose author went to great lengths to prevent transfers to disk, are so hard to put on disk that I doubt anyone can do so using software alone. Frankly, I have not had time to figure out how to transfer these new-generation ROM packs to disk in a simple fashion.

However, with hardware (a static RAM-based emulator of ROM packs), it should be easy to put any ROM pack, 32K or less, onto disk, load the data

---

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's *CoCo SIG and database manager of OS-9 Online.*

from the ROM pack into the emulator, and execute from there. While the ability to transfer ROM packs to disk opens the software up to piracy, forcing disk users to plug and unplug their controllers or jam cartridges in and out of their Multi-Pak Interfaces forces them to risk frying their CoCos. For this reason, a static RAM pack might become a legitimate commercial product someday.

New Sources for an Old Favorite

Now that the Deluxe RS-232 pack is unavailable, where can one get the hardware-UART capabilities it offered, which are needed by serious CoCo users?

John Burke
(JBURKE)
Fremont, California

There are two current sources of clones of the old (and now long discontinued) deluxe RS-232 pack. Disto/CRC makes one, and Orion makes two others. Disto's pack requires both positive and negative 12 volts, so a Multi-Pak Interface or a CoCo 1 is required. (Those voltages are not present on the CoCo 2 or 3 system bus.) Orion makes two versions of its RS-232 pack clone (called Telepak). One is similar to Disto's pack, but the other does not require a Multi-Pak to work on the CoCo 2 or 3. Like the old Tandy RS-232 pack, Orion's generates the extra voltages using DC-to-DC converter circuitry on board. See ads in RAINBOW.

Note that CRC, Owl-Ware, and Frank Hogg Laboratories all offer (or at one time offered) other RS-232 ports too, but these either use different UART chips or are addressed quite differently from the Tandy RS-232 pack. While these will work under OS-9, they necessitate rewriting all Disk BASIC software you want to use with them.

A Compatible Monitor

I have a Tandy 1000 and a CoCo 3. The ads in RAINBOW make the Magnavox 8CM515 look pretty good. They claim it will work with both computers (unlike the CM-8). Is this true?

Rick B. Morgan
(CONIBEAR)
Windsor, Connecticut

Yes. The Magnavox 8CM515 is a fine monitor, probably the best value today for those wanting to use the same monitor for the CoCo's RGB and the PC compatible's CGA system. I recommend it highly. I also recommend all RAINBOW advertisers who offer it.

A Good Program for a Different CoCo

I have a CoCo 2, a FD 501 drive and a DC Modem Pak from Tandy. I want to use GIMMESOFT's V-Term. *What other equipment do I need? I want to use* V-Term *because it offers VT-100 emulation, which I need to talk to my main frame.*

John V. Allen
(ALLENJOHNV)
Duncanville, Texas

V-Term is an excellent choice in terminal programs. However, it requires a CoCo 3. It cannot run on the CoCo 1 or 2. To do VT-100 emulation, you need an 80-column screen, unavailable on the CoCo 1 and 2. Either a Multi-Pak Interface or a Y cable are needed to use the DC Modem Pak with a CoCo 3 and a disk drive. I recommend a Multi-Pak. To use the Y cable you must remove the ROM from the DC Modem Pak, which can cause problems. I recommend you abandon the modem pack and use an RS-232 pack with a separate modem. The Tandy DC Modem Pak limits you to 300 baud and does not provide for future upgrades. With used 1200-baud modems available for $25 at computer swap meets and selling for about $90 brand new, the ability to use them or faster modems would seem to be quite important. See ads for CRC and Orion in RAINBOW. Also, note that Cer-Comp makes a terminal program for the CoCo 3 that emulates VT-100 terminals.

Your technical questions are welcomed. Please address them to CoCo Consultations, THE RAINBOW, P.O. Box 385, Prospect, KY 40059.

We reserve the right to publish only questions of general interest and to edit for brevity and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

Questions can also be sent to Marty through the Delphi CoCo SIG. From the CoCo SIG> prompt, pick Rainbow Magazine Services, then, at the RAINBOW> prompt, type `ASK` **(for Ask the Experts) to arrive at the EXPERTS> prompt, where you can select the "CoCo Consultations" online form which has complete instructions.**

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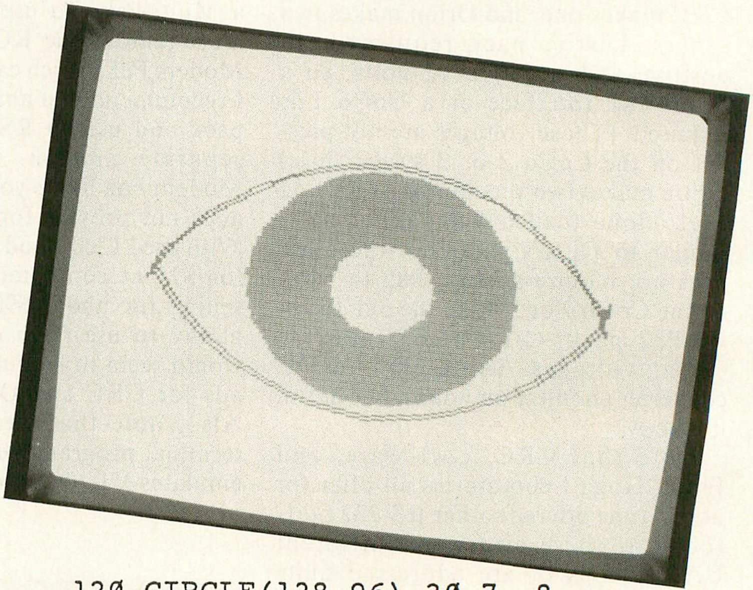


Big Brother's Watching

By Kenneth R. Hill

32K
ECB

In response to your November appeal for more submissions to Novices Niche, here is a program I wrote in 1981 for the original 32K CoCo 1. It's called *Blink*, and it draws a big blue eye. Watch it closely while it's watching you — yes, it blinks! If you want your eye to blink a little faster, change the `400` in Line 270 to `100`. For sound, add this line: `255 SOUND 250,1`.

The Listing: BLINK

```
0 ' COPYRIGHT 1989  FALSOFT,INC
1 'BLINK. by K.R.Hill
5 'Draws a blinking blue eye. Ty
pe CMP if a CM-8 monitor is in u
se.
10 PCLEAR 8
20 PMODE 3,5
30 PCLS
40 PMODE 3,1
50 PCLS
60 SCREEN 1,1
70 CIRCLE(128,191),156,8,1,.60,.
91
80 CIRCLE(128,191),158,8,1,.60,.
91
90 CIRCLE(128,0),160,8,1,.10,.40
100 CIRCLE(128,0),162,8,1,.10,.4
0
110 CIRCLE(128,96),74,7,.8
120 CIRCLE(128,96),30,7,.8
130 PAINT(128,150),7,7
140 FOR N=1 TO 4
150 READ A,B
160 PCOPY A TO B
170 NEXT N
180 DATA 1,5,2,6,3,7,4,8
190 RESTORE
200 PAINT(128,36),6,8
210 PMODE 3,5
220 SCREEN 1,1
230 FOR T=1 TO 2000:NEXT T
240 PMODE 3,1
250 SCREEN 1,1
260 PAINT(128,36),6,8
270 FOR T=1 TO 400:NEXT T
280 GOTO 210
290 END
```

CoCo of Many Colors

CoCo 3

By Andy Wolstromer

CoColeidoscope uses random numbers, trigonometry and the `PALETTE` command to produce a colorful imitation of a kaleidoscope on your CoCo 3. Just type it in and run it. If you like to experiment, try changing the `HLINE` statement in Line 510 to draw `HCIRCLE`s, or you could even `HDRAW` a shape of your own. Also, try changing the way `OX` and `OY` are calculated. Just make sure that any changes you make stay in the range of the screen.

The Listing: `COCOLEID`

```
0 ' COPYRIGHT 1989  FALSOFT,INC
10 'CoColeid by Andy Wolstromer
20 POKE65497,0:ONBRKGOTO999
30 HSCREEN2
40 PALETTE0,0
50 P4=ATN(1)
100 R=RND(80):AN=RND(0)*P4:C=RND
(15):SZ=RND(5)
110 OX=INT(COS(AN)*R):OY=INT(SIN
(AN)*R)
120 X=160-OX:Y=96-OY:GOSUB500
130 X=160-OX:Y=96+OY:GOSUB500
140 X=160+OX:Y=96-OY:GOSUB500
150 X=160+OX:Y=96+OY:GOSUB500
160 X=160-OY:Y=96-OX:GOSUB500
170 X=160-OY:Y=96+OX:GOSUB500
180 X=160+OY:Y=96-OX:GOSUB500
190 X=160+OY:Y=96+OX:GOSUB500
200 GOTO100
500 PALETTERND(15),RND(63)
510 HCOLORC:HLINE(X-SZ,Y-SZ)-(X+
SZ,Y+SZ),PSET,B
520 RETURN
999 RGB:POKE65496,0:END
```

Turning Text Graphics Into Title Screens

16K
ECB

By Greg Bauer

ASCII Calc is a program to calculate the ASCII values of text graphics characters. These values may then be used in your programs in data lines to produce title screens, etc. In fact, this principle was used in the title screen of this program, beginning in Line 220. To save memory, the program subtracts 128 from the actual ASCII value and adds it back in the `READ` command, as shown in Line 240.

I use a `PRINT @` sheet to plan my screens and then use this program for the data lines. Now you can easily dress up your programs for a pleasing effect.

The Listing: `ASCICALC`

```
0 ' COPYRIGHT 1989  FALSOFT,INC
10 'PROGRAM TO CALCULATE ASCII
   GRAPHICS FOR DATA LINES
20 'GREG BAUER
30 '6411 SO. ALDER
40 'TACOMA,WA. 98409
50 GOSUB200
60 CLS
70 PRINT@42,"COLOR NUMBERS";:PRI
NT@101,"0=GREEN          1=YELLOW"
;:PRINT@165,"2=BLUE          3=RE
D";:PRINT@229,"4=BUFF           5=
CYAN";:PRINT@293,"6=MAGENTA
 7=ORANGE";
80 PRINT:PRINT:LINEINPUT"
   ENTER (0-7)";C$:C=VAL(C$):IFC
<0 OR C>7 THEN80
90 CLS
100 PRINT@41,"PATTERN NUMBERS";
110 PRINT@100,CHR$(192)"=0";:PRI
NT@107,CHR$(193)"=1";:PRINT@114,
CHR$(194)"=2";:PRINT@121,CHR$(19
5)"=3";
120 PRINT@164,CHR$(196)"=4";:PRI
NT@171,CHR$(197)"=5";:PRINT@178,
CHR$(198)"=6";:PRINT@185,CHR$(19
9)"=7";
130 PRINT@228,CHR$(200)"=8";:PRI
NT@235,CHR$(201)"=9";:PRINT@242,
CHR$(202)"=10";:PRINT@249,CHR$(2
03)"=11";
140 PRINT@292,CHR$(204)"=12";:PR
INT@299,CHR$(205)"=13";:PRINT@30
6,CHR$(206)"=14";:PRINT@313,CHR$
(207)"=15";
150 PRINT:PRINT:LINEINPUT"
    ENTER (0-15)";P$:P=VAL(P$)
160 IFP<0 OR P>15THEN150
170 CLS:A=(16*C)+P:PRINT@265,"AS
CII#-128=";A
180 INPUT"                 AGAIN";A
$:IFA$="Y"THEN60ELSEIFA$="N"THEN
190ELSE180
190 CLS:END
200 CLS0:FORI=1TO32:PRINTCHR$(12
8);:NEXT
210 FORI=1TO32:PRINTCHR$(204);:N
EXT
220 FORI=1TO96:READ A:PRINTCHR$(
128+A);:NEXT
230 FORI=1TO32:PRINTCHR$(195);:N
EXT
240 PRINT@266,"PRESENTED BY";:PR
INT@363,"GREG BAUER";:PRINT@455,
"COPYRIGHT (C) 1988";
250 FORX=1TO4000:NEXT:RETURN
260 DATA0,,46,45,,46,44,,46,44,,
45,40,36,46,,,,46,44,,46,45,,42,
,,46,44,,,0
270 DATA0,,43,39,,44,45,,42,,,37
,,,42,,,,42,,,43,39,,42,,,42,,,,
0
280 DATA0,,42,37,,35,39,,43,35,,
39,34,33,43,,,,43,35,,42,37,,43,
35,,43,35,,34,0
```

Five-Column Directories

CoCo 3

By Bill Bernico

Here's a handy little utility for CoCo 3 users, a program that will list the disk directory to either the screen or the printer in five-column format. Naturally, it works in the 80-column mode, so it looks best if run with an RGB monitor. The program is very easy to use: Just type it in, run it and when prompted, press S or P for output to screen or printer.

The Listing: 5-COLDIR

```
0 ' COPYRIGHT 1989  FALSOFT,INC
1 '5 COLUMN DIRECTORY LISTER
   FOR THE COCO 3 (C)1988
   FROM BILL BERNICO SOFTWARE

2 CLEAR2000:DIMX$(75)
3 WIDTH80:PALETTE1,0:ATTR3,1:CLS
:CLS:INPUT"OUTPUT TO SCREEN OR P
RINTER     (S/P) ";Y$
4 IFY$="S"THEND=0ELSEIFY$="P"THE
ND=-2ELSE3
5 CLS:FORX=3TO11:DSKI$0,17,X,A$,
B$:C$=A$+LEFT$(B$,127):FORQ=1TO2
55STEP32:IFMID$(C$,Q,1)=CHR$(0)T
HEN7ELSEIFMID$(C$,Q,1)=CHR$(255)
THEN8
6 X$(I+X-3)=MID$(C$,Q,11):I=I+1
7 NEXTQ,X
8 FORL=0TO4:FORM=0TOI+3:IFLEN(X$
(M))<>0 THENPRINT#D,"   ";X$(M);"
   ";ELSE9
9 NEXTM:PRINT#D:PRINT#D:PRINT#D,
"  FREE GRANULES =";FREE(0):PRIN
T:PRINT"  ANOTHER DISK (Y/N)";
10 I$=INKEY$:IFI$="Y"THEN3ELSEIF
I$="N"THENWIDTH32:ENDELSE10
```

Has Anyone Seen My String?

16K
Disk

By Stephen Miller

ASC Search is a short and sweet way to find those variables, strings and comments that could be located anywhere throughout a BASIC program. Generally, I am a lazy individual — the more work I can get my computer to do for me, the better my life becomes. I got quite tired of trying to find where all those A$s are in my programs and decided to find a way for the computer to do it for me.

ASC Search can help you in finding bugs, variables, comments and any information that may be in a BASIC listing. These "comments" could range from a single letter to a complete word or sentence — but all of them must be within a program that has been saved in ASCII format in this fashion: SAVE*"filename"*,A.

When run, *ASC Search* asks if you would like a hard copy of the results sent to the printer. The program then prompts you for the filename of the ASCII-saved program you want to search. (If the program is on another drive, type DRIVE *n* — DRIVE 1, for example, if the file is on Drive 1 — before running *ASC Search*.) When you separate the filename and extension, use the period (.) and not the slash (/). If you run the program again, you need not enter the filename again: *ASC Search* remembers the last filename used and displays this when you press ENTER.

Next you are asked for "target letters" — what you are searching for. This could be any string of letters you want. You are also offered a pause option, which will cause the computer to wait for a key press after every occurrence of the string it finds. However, don't use the pause option if you're searching for numbers or special characters (#$%&+@), as you'll be presented with an FC (Function Call) Error. Any other symbol is acceptable.

The file will be searched and displayed until the end is reached, or until the program has found more than 1,000 occurrences of the target string. Then it will stop and display a report of the results, giving you a hard copy if you selected the printer option. The report tells you how many occurrences of the target string there are, and also the lines in which they are found. It even tells you how many lines are in your program.

If the program is too slow for your tastes, you can add the speed-up poke to Line 11 (POKE 65495,0 for the CoCo 2 and POKE 65497,0 for the CoCo 3). But remember: The pokes affect printer operation (baud rate is changed); so if you're printing a hard copy, don't use the speed-up poke — you could add the slow-speed poke to lines 18 and 23 (not forgetting to add the speed-up poke again at the end of Line 18).

Use *ASC Search* to eliminate all that time spent squinting over a listing with a marker, looking for those A$s. Go watch a ball game instead!

The Listing: ASCSERCH

```
0 'ASCSERCH.BAS
1 '********************************
2 '**    ASCII    FILE SEARCH    **
3 '**    VERSION 2.0   APR/88    **
4 '**    BY:   STEPHEN MILLER    **
5 '**  (C) 1989   FALSOFT,INC    **
6 '********************************

11 CLEAR20,&H7F00:CLEAR5000:DIMZ
$(20):CLS:PRINTTAB(6)"ASCII PROG
RAM SEARCH":D$=INKEY$
12 PRINT@64,"PRINTER (Y/N) ? ";:
```

```
D$=INKEY$:IFD$=""THEN12ELSEIFD$=
"Y"THENPRINT"YES":D=-2ELSEPRINT"
NO":D=0
13 PRINT:LINEINPUT" FILENAME.EXT
 OF 'ASC' PROGRAM:  ";N$:IFN$=""
THENFORT=1TO12:N$=N$+CHR$(PEEK(&
H7F00+T)):NEXT:PRINT@161,N$:GOTO
16
14 A=A+1:IFMID$(N$,A,1)<>"."THEN
14ELSEN1$=LEFT$(N$,A-1):N2$=RIGH
T$(N$,3)
15 IFLEN(N1$)<8THENN1$=N1$+" ":G
OTO15ELSEN$=N1$+"."+N2$:FORT=1TO
12:POKE&H7F00+T,ASC(MID$(N$,T,1)
):NEXT
16 PRINT@224,"";:LINEINPUT"ENTER
 TARGET LETTERS (WORDS)     >";T$
:L=LEN(T$):IFL<1THEN16
17 PRINT@320,"DO YOU WANT 'PAUSE
' (Y/N) ? ";:P$=INKEY$:IFP$=""TH
EN17ELSEIFP$="Y"THENPRINT"YES"EL
SEPRINT"NO"
18 IFD$="Y"THENPRINT#D,"ASCII FI
LESEARCH":PRINT#D,"SEARCHING FOR
 ";CHR$(34)T$CHR$(34):PRINT#D,"F
ILENAME:- "N$
19 OPEN"I",#1,N$
20 LINEINPUT#1,A$:NT=NT+1:CLS:PR
INTA$
21 FORT=1TOLEN(A$):IFMID$(A$,T,L
)=T$THENSOUND225,2:GOSUB25:GOSUB
26:TN=TN+1:IFLEN(Z$(W))>200THENW
=W+1:IFTN>1000THENPRINT"THERE AR
E FAR TOO MANY OCCURANCEOF "CHR$
(34)T$;CHR$(34)" TO CONTINUE.":G
OTO23
22 NEXT:IFEOF(1)THEN23ELSE20
23 CLOSE#1:PRINT"<<finished>>":P
RINT#D:PRINT#D,"YOUR PROGRAM USE
S"NT-1"LINES":PRINT#D,"THERE WER
E"TN"OCCURANCES":PRINT#D,"IN LIN
ES ";:FORT=0TOW:IFT=1THENPRINT"
 <ENTER> TO LIST MORE...":EXEC44
539:NEXTELSEPRINT#D,Z$(T):NEXT
24 PRINT"OF "CHR$(34)T$CHR$(34):
PRINT"IN YOUR "N$" PROGRAM":PRIN
T"  <L>IST AGAIN   OR   <R>UN";:
EXEC44539:N$=CHR$(PEEK(135)):IFN
$="L"THEN23ELSERUN
25 FORR=1TO6:Y$=MID$(A$,R,1):IFY
$=" "THEN Z$(W)=Z$(W)+",":RETURN
ELSEZ$(W)=Z$(W)+Y$:NEXT:RETURN
26 IFP$="Y"THENPOKE1024+(T-1),AS
C(LEFT$(T$,1)):FORV=1TO50:NEXT:I
FINKEY$=""THENPOKE1024+(T-1),(AS
C(LEFT$(T$,1))-64):FORV=1TO50:NE
XT:IFINKEY$=""THEN26
27 RETURN:ENDend
```

Science

The Mathematics of Chaos

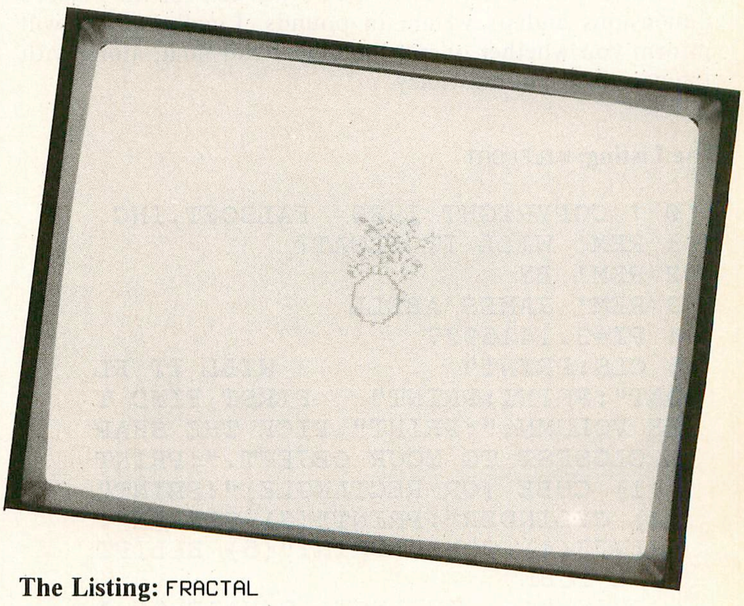
16K
ECB

By John E. Phillips

Fractals are branching geometric forms whose details recur at different scales. Examples in nature include the veins in a leaf, the branches of a tree and the formation of an island chain. Fractal geometry, a recent branch of mathematics fathered by Benoit Mandelbrot, is a method of explaining random events.

While supercomputers are currently being used to produce fractal patterns, your CoCo can also generate fractals, though much more slowly (this program takes over an hour to produce the image). However, the CoCo is thousands of times less expensive!

Fractal creates its pattern by sending dots toward the center of the screen where a circle has been placed. When these randomly projected dots touch the circle or each other, they set to form the design. When the circle changes color, the program is finished. I have used the speed-up poke for the CoCo 3 in Line 100. If you have a CoCo 1 or 2, be sure to delete this poke or to supply the poke appropriate to your machine (`POKE 65495,0` for the CoCo 2).



The Listing: FRACTAL

```
0 ' COPYRIGHT 1989  FALSOFT,INC
100 POKE65497,0:PMODE3,1
110 PCLS:SCREEN1,1
120 CIRCLE(128,96),15,8
130 A=RND(255):X=A
140 IFY<99THENY=0
150 IFA<52THENX=X+1.3
```

```
160 IFA>52ANDA<=96THENX=X+.9
170 IFA>96ANDA<=114THENX=X+.5
180 IFA>114ANDA<=143THENX=X
190 IFA>143ANDA<=192THENX=X-.5
200 IFA>192ANDA<=220THENX=X-.9
210 IFA>220THENX=X-1.3
220 Y=Y+1:PSET(X,Y)
230 IFPPOINT(X+1,Y+1)=8THEN130
240 IFPPOINT(X-1,Y-1)=8THEN130
250 IFPPOINT(X+1,Y-1)=8THEN130
260 IFPPOINT(X-1,Y+1)=8THEN130
270 PRESET(X,Y)
280 IFPPOINT(X,3)=8THEN300
290 IFY<99THEN150ELSEY=0:GOTO130
300 PAINT(128,96),8:GOTO280
```

Does Archimedes' Discovery Hold Water?

4K

By James Abell

Will It Float? is a program based on the principles outlined in the writings of Archimedes (287 to 212 B.C.). As the story goes, Archimedes was working on an invention and became so engrossed in thought that he forgot to eat and neglected his personal hygiene.

After days of such neglect, his friends decided to bathe him. While in the tub, Archimedes continued to think and suddenly jumped out of the tub and ran home, naked, screaming, "Eureka!" (i.e., "I've found it!") What he "found" was that a body displaces its own weight in water.

Using the CoCo and Archimedes' discovery, you can determine if objects around the house can hold their own in water. Type in the listing and save it to tape or disk. When you run the program, think of an object. You will be asked to provide the closest approximation of your object's shape (cylinder, sphere, etc.). Then CoCo will ask for the object's dimensions and its weight in pounds. Finally, CoCo will inform you whether or not the object will float, along with the percentage of buoyancy.

The Listing: WILFLOAT

```
0 ' COPYRIGHT 1989  FALSOFT,INC
1 REM' WILL IT FLOAT?
2 REM' BY
3 REM' JAMES ABELL
4 PI=3.1415927
5 CLS:PRINT"            WILL IT FL
OAT":PRINT:PRINT"   FIRST,FIND T
HE VOLUMN.":PRINT" PICK THE SHAP
E CLOSEST TO YOUR OBJECT.":PRINT
"(1) CUBE (OR RECTANGLE)":PRINT"
(2) CYLINDER":PRINT"(3) SPHERE":
PRINT"(4) CONE":PRINT"(5) ELLIPT
ICAL TUBE"
6 PRINT"(6) TRIANGULAR(HALF OF A
 CUBE)"
7 INPUTA:ON A GOSUB 8,10,12,14,1
6,18
8 CLS:PRINT"CUBE":PRINT"ENTER LE
NGTH":INPUTL:PRINT"ENTER WIDTH":
INPUTW:PRINT"ENTER HEIGHT":INPUT
H
9 A=L*W:V=A*H:GOTO20
10 CLS:PRINT"CYLINDER":PRINT"ENT
ER DIAMETER":INPUTD:PRINT"ENTER
LENGTH":INPUTL
11 R=D/2:A=(R^2)*PI:V=A*L:GOTO20
12 CLS:PRINT"SPHERE":PRINT"ENTER
 DIAMETER":INPUTD
13 R=D/2:V=((4/3)*PI)*(R^3):GOTO
20
14 CLS:PRINT"CONE":PRINT"ENTER D
IAMETER":INPUTD:PRINT"ENTER LENG
TH":INPUTL
15 R=D/2:V=((R^2)*PI*L)/3:GOTO20
16 CLS:PRINT"ELLIPTICAL TUBE":PR
INT"ENTER DIAMETER LONGEST SIDE"
:INPUTDA:PRINT"ENTER DIAMETER SH
ORTEST SIDE":INPUTDB:PRINT"ENTER
 LENGTH":INPUTL
17 RA=DA/2:RB=DB/2:A=RA*RB*PI:V=
A*L:GOTO20
18 CLS:PRINT"TRIANGULAR(HALF OF
CUBE)":PRINT"ENTER LENGTH":INPUT
L:PRINT"ENTER WIDTH":INPUTW:PRIN
T"ENTER HIGHT":INPUTH
19 A=L*W:V=A*H:GOTO20
20 CLS:PRINT"ENTER OBJECT WEIGHT
 IN POUNDS":INPUT WT:WW=62.5:PRI
NT"WERE THE DIMENSIONS IN (1) FE
ET OR (2) INCHES?":INPUTA:IFA=1T
HEN24 ELSE IF A=2 THEN 21
21 PRINT"INCHES":WI=62.5/1728:WZ
=WI*V:IF WT>WZ THEN 22 ELSE IF W
T<WZ THEN 23
22 PRINT"IT WILL SINK!":P=(WZ/WT
)*100:P=100-P:PRINT" IT IS"P"% T
OO HEAVY":GOTO27
23 PRINT"IT WILL FLOAT!":P=(WT/W
Z)*100:P=100-P:PRINT" IT IS"P"%
BOUYANT":GOTO 27
24 PRINT"FEET":WI=62.5:WZ=WI*V:I
F WT>WZ THEN 25 ELSE IF WT<WZ TH
EN 26
25 PRINT"IT WILL SINK!":P=(WZ/WT
)*100:P=100-P:PRINT"IT IS"P"% TO
O HEAVY":GOTO27
26 PRINT"IT WILL FLOAT!":P=(WT/W
Z)*100:P=100-P:PRINT"IT IS"P"% B
OUYANT":GOTO27
27 PRINT:PRINT"  PRESS ENTER TO
RETURN...":INPUTA$:GOTO5
```

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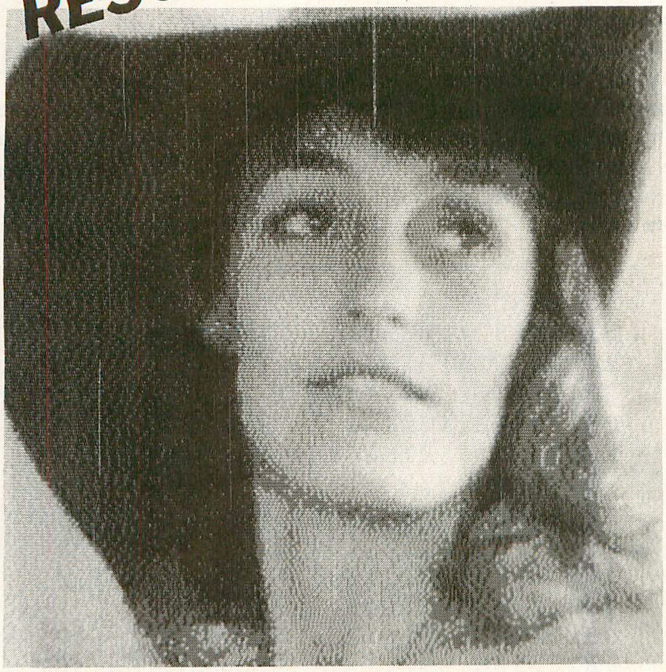

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Simulate a numeric keypad

From Keyboard to Keypad

By Fred B. Scerbo
Rainbow Contributing Editor

If you have an idea for the "Wishing Well," submit it to Fred c/o THE RAINBOW. Remember, keep your ideas specific, and don't forget this is BASIC. All programs resulting from your wishes are for your use, but remain the property of the author.

Ask any CoCo owner what feature he or she would most like to see added to our wonder machine. Nine out of 10 owners will say they want a numeric keypad. While newer Tandy computers have this feature included as a standard, there are no plans to add it to our trusty Color Computer.

Still, what Tandy cannot give us in hardware, we can accomplish in software. I am going to show you how to use your CoCo like a pocket calculator. The program *Q-Lator* will do this with great precision. However, that is all it will do. (Don't expect to combine it with a spreadsheet program.)

One Step Forward, Two Steps Back?

Many of you already own pocket calculators, so why would you want to use your CoCo for one? Believe it or not, there are times when you don't have that calculator on hand. I can recall many times at the computer when I wanted to work out some calculation, but I didn't want to type `? 24.56-11.73` just to do a simple math function, either.

Fred Scerbo is a special needs instructor for the North Adams Public Schools in North Adams, Massachusetts. He holds a master's in education and has published some of the first software available for the Color Computer through his software firm, Illustrated Memory Banks.

That is where *Q-Lator* comes in. Let's say you need to check your child's math problems. Pop in *Q-Lator*, and you have a fully functioning calculator at your fingertips. Granted, it will not do SIN/COS/TAN and other advanced functions of some calculators. However, it will add, subtract, multiply, divide and do square roots.

The Listing

The listing may appear long for a program that appears to do so little, but there are several reasons for this. First, I wanted to be sure that we had an attractive screen. By using `PMODE 0`, we get large, vibrant black and white graphics that are not confusing. When a key is pressed for a number, the key will also flash on the screen. (This makes it an excellent training tool for those just learning to use a pocket calculator.)

Second, I needed to write subroutines that worked a certain way one time and a different way the next time. This could be accomplished with a ton of `IF/THEN` statements, but it would also slow down the program. Even though `PMODE 0` will work with lightening speed, we don't need anything slowing down the subroutines.

That is why you will find some subroutines duplicated with their necessary variations — it allows them to be executed more rapidly.

When you type in the listing, make sure you enter all the `DATA` statements correctly. Most bugs in the programs people write to me about come from a failure to get the typing done correctly.

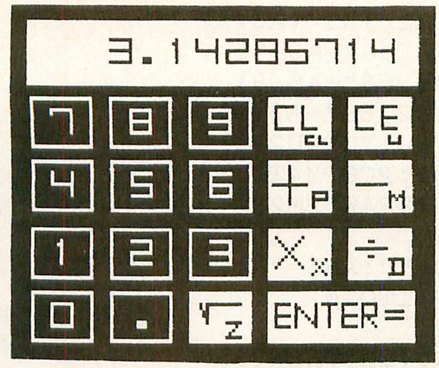
Using the Program

When you run the program, you will see a familiar title screen. Press ENTER to start the program. You will see a calculator pictured on the entire screen. Although not pictured, the minus sign (-) is used for a negative value. If you want to enter the number -25, press the

50	236	390	80
85	247	500	35
160	145	630	86
265	120	END	49

The Listing: `QLATOR`

```
1 REM*****************************
2 REM*       CO CO Q-LATOR       *
3 REM*   KEYBOARD CALCULATOR     *
4 REM*     BY FRED B.SCERBO      *
5 REM*    COPYRIGHT (C) 1988     *
6 REM*      60 HARDING AVE       *
7 REM*   NORTH ADAMS,MA 01247    *
8 REM*****************************
9 CLEAR2000
10 CLS0:PRINTSTRING$(64,188);
15 FORI=1TO 256 :READ A:PRINTCHR
$(A+128);:NEXT
20 PRINTSTRING$(32,188);
25 PRINT@390," KEYBOARD CALCULAT
OR ";:PRINT@422,"  BY FRED B. SC
ERBO  ";:PRINT@454," COPYRIGHT
(C) 1988 ";
30 DATA30,28,26,30,28,26,37,44,4
4,44,45,32,32,100,110,96,96,101,
108,108,106,110,109,108,106,110,
108,109,101,108,108,109
35 DATA26,,16,26,,26,37,32,,,37,
,32,,106,96,,101,,96,106,104,101
,96,104,106,96,101,101,96,,101
40 DATA27,19,26,27,19,26,37,32,,
,37,,32,16,106,96,,101,,96,106,9
6,101,,96,106,96,101,101,96,96,1
01
```



negative sign (or hyphen) on the keyboard to assign the negative value. This is not the same as the subtraction (minus) key, which will be designated by the letter M for minus.

The CLEAR key works just as it does on any calculator. However, to clear a single entry (clear entry), you must press U (for undo). Clear entry prevents having to re-enter a long list of numbers when you make an error. It clears only the last number entered.

The four math function — addition, subtraction, multiplication and division — are represented by the letters P, M, X and D. They are as follows:

Add:	P for plus
Subtract:	M for minus
Multiply:	X for times
Divide:	D for divide

Z gives you the square root function. To perform the "equals" function, press ENTER. You do not need to remember these functions since each key on the screen has the letter it represents in that box.

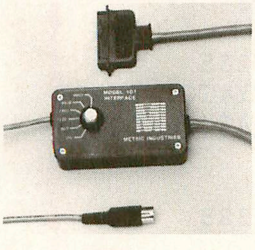
That's all there is to it. You can continue to perform math functions on any answer *Q-Lator* generates. If a number is too large, you will get an Overflow Error. Sorry, I didn't include exponents on this calculator. In addition, the keyboard can take no number longer than 10 digits, so keep the numbers short.

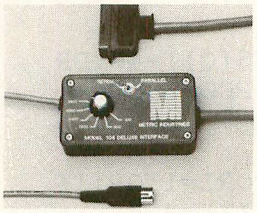
Conclusion

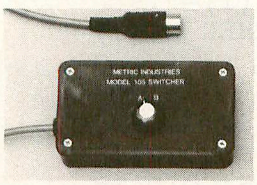
I think you will find *Q-Lator* handy. I have already put it to good use with my students. Next month, I hope to offer a program that anyone who runs a small business will be thrilled to use.

Keep those ideas coming in. ☐

```
45 DATA19,19,18,19,19,18,37,32,,
,37,68,76,64,106,96,,101,108,108
,106,96,101,,96,106,96,101,101,1
08,109,108
50 DATA26,,24,26,,26,37,32,35,32
,37,,32,,106,96,,101,,96,106,96,
101,,96,106,96,101,101,96,100,10
6
55 DATA26,,18,26,,26,37,32,36,43
,37,,32,,106,96,97,101,96,96,106
,96,101,,96,106,96,101,101,96,,1
09
60 DATA28,28,24,28,28,24,36,44,4
4,44,47,32,32,100,108,108,108,10
0,96,96,104,96,108,104,96,108,10
8,108,100,104,96,100
```







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- ★ Comes complete with cables to connect to your printer and computer
- ★ Can be powered by most printers

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- ★ **Same Features as 101 Plus**
- ★ Built in Serial Port for your Modem or other serial device
- ★ Switch between Serial Output and Parallel Output
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Model 105 Serial Switch

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- ★ Comes with a 3 foot cable to connect to your computer
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- ★ **Automatically Centers Each Line of Text**
- ★ Allows editing of label before printing
- ★ Program comes with 24 labels to get you started
- ★ 16K ECB required

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Some of the Printers That Cannot –
Supply power for the interfaces are Epson, Seikosha, Panasonic, Silver Reed and NEC. If your printer cannot supply power to the interface you can order your interface with the "P" option or you can supply your own AC adapter. We recommend the Radio Shack 273-1431 AC adapter with a 274-328 connector adapter.

Write or call for more information or for technical assistance.

Price List

Model 101	**35.95**
Model 101P	41.95
Model 104	44.95
Model 104P	51.95
Model 105	14.95
Cassette Label Program	6.95
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Colors (specify)	3.60/C
Red-Blue-Yellow-Tan	

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Cincinnati, OH 45242

(513) 677-0796

```
65 DATA60,60,60,60,60,60,60,60,6
0,,36,40,,60,60,60,60,60,60,60,6
0,60,60,60,60,60,60,60,60,60,60,
60
70 X$=INKEY$:IFX$<>CHR$(13)THEN7
0
75 DIM S$(5),A$(11),A(9),B(9),N$
(11)
80 FORI=0TO11:READA$(I):NEXT:FOR
I=1TO5:READS$(I):NEXT:FORI=0TO9:
READA(I),B(I):NEXT
85 DATA U12L12D12NR12BL6,BL6U12N
G2D12BL10,L12U6R12U6L12BD12BL6,N
L12U6NL12U6L12BD12BL6,U12D6L12NU
6BD6BL6,NL12U6L12U6NR12BD12BL6
90 DATA NU6L12U6NR12U6NR12D12BL6
,U12L12D2BD10BL6,U12L12D6NR12D6N
R12BL6,NL12U6NL12U6L12D6BD6BL6,B
L6NL4U2L4D2BL8,BU6L12BD6BL6,BU6R
12,BU6R6NU6ND6R6,E6NH6NE6F6,BU6R
6NR8BU4NR2BD8R2,"BU10M+4,+10U10R
12"
95 DATA 10,153,10,118,58,118,106
,118,10,83,58,83,106,83,10,48,58
,48,106,48
100 PMODE0,1:PCLS1:SCREEN1,1:PMO
DE0,4:PCLS0
105 LINE(10,8)-(244,42),PSET,BF
110 FORI=0TO230STEP48
115 FORY=0TO120STEP35
120 LINE(12+I,50+Y)-(48+I,76+Y),
PSET,B:NEXTY,I
125 LINE(156,155)-(242,181),PSET
,BF
130 FORI=158TO230STEP48:FORY=54T
O126STEP35
135 PAINT(0+I,0+Y),1,1
140 NEXTY,I
145 PAINT(136,175),1,1
150 DRAW"BM160,172C0NR8U6NR8U6R8
BR4ND12F12U12BR4R4ND12R4BR4NR8D6
NR8D6R8BR4U12R8D6L8R2F6BR6BU4NR1
0BU4R10"
155 DRAW"BM160,140E8NF8NH8NE8BF1
0BR4BU6F4NE4NF4NG4BE10BR12R8NR10
BU4NR2BD8R2BR10BD2R8D8L8R2U8"
160 DRAW"BM168,96NU10ND10NL10R10
BD4BR4R8D4L8U4D8BE12BR14R18BR2BD
4ND8F4E4D8"
165 DRAW"BM160,66NR10U12R10BR6D1
2R8BG4BL2NR4D4R4BR4NU4R4"
170 DRAW"BM208,66NR10U12R10BR6NR
8D6NR8D6R8BG4D4R6U4"
175 DRAW"BM138,160L20D10M-4,-10B
F10BR6R8G8R8"
180 DRAW"BM36,172C1"+A$(0)
185 DRAW"BM36,138"+A$(1)
190 DRAW"BM84,138"+A$(2)
195 DRAW"BM132,138"+A$(3)
200 DRAW"BM36,103"+A$(4)
205 DRAW"BM84,103"+A$(5)
```

```
210 DRAW"BM132,103"+A$(6)
215 DRAW"BM36,68"+A$(7)
220 DRAW"BM84,68"+A$(8)
225 DRAW"BM132,68"+A$(9)
230 DRAW"BM76,172R4U2L4"
235 PCOPY4TO1:PCOPY4TO3
240 PMODE0,1:DRAW"BM230,30C0"+A$
(0):PMODE0,4
245 F$="":S$="":AN$="":D=0:E=0:G
S=0:R=0:FORP=1TO10
250 GOSUB540
255 IFX$=CHR$(12)THEN235
260 N$(P)=CHR$(48+X)
265 DRAW"BM230,30C0"
270 FORQ=P TO 1STEP-1
275 PMODE0,3:QQ=ASC(N$(Q))-48:DR
AW"C0"+ A$(QQ):NEXTQ:PCOPY3TO1
280 PCOPY4TO3
285 IFR>0THEN295
290 NEXTP:P=P-1:IFP=10THEN GS=1:
GOSUB540
295 GOSUB700
300 FORI=1TOP:IF ASC(N$(I))=58TH
EN N$(I)="."
305 IF ASC(N$(I))=59THEN N$(I)="
-"
310 F$=F$+N$(I):NEXTI
315 IF R=5 THEN 400
320 GOSUB700
325 D=0:E=0:FORP=1TO10
330 PCOPY4TO3:PMODE0,3
335 GOSUB635
340 IFX$=CHR$(12)THEN235
345 IFX$="U"THEN:PCOPY4TO1:PMODE
0,1:DRAW"BM230,30C0"+A$(0):GOTO3
25
350 N$(P)=CHR$(48+X)
355 IFX$=CHR$(13)THEN385
360 DRAW"BM230,30C0"
365 FORQ=P TO 1STEP-1
370 PMODE0,3:QQ=ASC(N$(Q))-48:DR
AW"C0"+ A$(QQ):NEXTQ:PCOPY3TO1
375 PCOPY4TO3
380 NEXTP
385 PCOPY4TO1:P=P-1:FORI=1TOP:IF
 ASC(N$(I))=58THEN N$(I)="."
390 IF ASC(N$(I))=59THEN N$(I)="
-"
395 S$=S$+N$(I):NEXTI
400 F=VAL(F$):S=VAL(S$)
405 IF R=1 THEN AN=F-S:GOTO435
410 IF R=2 THEN AN=F+S:GOTO435
415 IF R=3 THEN AN=F*S:GOTO435
420 IF R=4 AND S=0 THEN 705
425 IF R=4 THEN AN=F/S
430 IF R=5 THEN AN=SQR(F)
435 PCOPY4TO3
440 AN$=STR$(AN):IF AN=>0 THEN P
=LEN(AN$)-1:AN$=RIGHT$(AN$,P):EL
SE P=LEN(AN$)
445 IF P>10THEN705
```

```
450 DRAW"BM230,30"
455 FORQ=P TO 1STEP-1
460 PMODE0,3:QQ=ASC(MID$(AN$,Q,1
))-48:IF QQ=-2THENQQ=10
465 IF QQ=-3THENQQ=11
470 IFQQ=21THEN705
475 IFQQ=-5THEN705
480 DRAW"C0"+A$(QQ):NEXTQ:PCOPY3
TO1
485 FORI=1TO10:N$(I)="":NEXT
490 F$=AN$:S$="":F=0:S=0
495 X$=INKEY$:IFX$=""THEN495
500 IFX$=CHR$(12)THEN235
505 IFX$="U"THEN235
510 IFX$="M"THEN R=1:GOTO320
515 IFX$="P"THEN R=2:GOTO320
520 IFX$="X"THEN R=3:GOTO320
525 IFX$="D"THEN R=4:GOTO320
530 IFX$="Z"THEN R=5:GOTO400
535 GOTO495
540 X$=INKEY$:IFX$=""THEN540
545 IFP=1THEN585
550 IFX$="M"THEN R=1:P=P-1:RETUR
N
555 IFX$="P"THEN R=2:P=P-1:RETUR
N
560 IFX$="X"THEN R=3:P=P-1:RETUR
N
565 IFX$="D"THEN R=4:P=P-1:RETUR
N
570 IFX$="Z"THEN R=5:P=P-1:RETUR
N
575 IFE=1THEN585
580 IFX$="-"AND P=1 THEN X=11:E=
1:RETURN
585 IFX$=CHR$(12)THENRETURN
590 IF GS=1THEN540
595 IFD=1 AND X$="."THEN540
600 IFX$="."THEN X=10:D=1:RETURN
605 XX=ASC(X$):XX=XX-48
610 IFXX<0THEN540
615 IFXX>9THEN540
620 X=XX
625 PMODE0,1:LINE(A(X),B(X))-(A(
X)+40,B(X)+30),PSET,B:PLAY"P36":
LINE-(A(X),B(X)),PRESET,B:PMODE0
,3
630 RETURN
635 X$=INKEY$:IFX$=""THEN635
640 IFX$=CHR$(12)THENRETURN
645 IFX$="U"THENRETURN
650 IFE=1THEN660
655 IFX$="-"AND P=1 THEN X=11:E=
1:RETURN
660 IFD=1 AND X$="."THEN540
665 IFX$="."THEN X=10:D=1:RETURN
670 X=ASC(X$):X=X-48
675 IFX$=CHR$(13)THENRETURN
680 IFX<0THEN635
685 IFX>9THEN635
690 PMODE0,1:LINE(A(X),B(X))-(A(
X)+40,B(X)+30),PSET,B:PLAY"P32":
LINE-(A(X),B(X)),PRESET,B:PMODE0
,3
695 RETURN
700 PMODE0,1:DRAW"BM24,30C0"+S$(
R):RETURN
705 PMODE0,1:DRAW"BM56,30C0U12R1
2D12NL12BR6BU12M+6,+12M+6,-12BR6
NR12D6NR12D6R12BR6U12R12D6L12R6F
6BR6U6NR12U6R12BR6D12R12BR6U12R1
2D12NL12BR6NU12R6NU6R6U12"
710 X$=INKEY$:IFX$=""THEN710
715 IFX$=CHR$(12)THEN235
720 IFX$="U"THEN235
725 GOTO710
```

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The second in a series of tutorials on designing a database

Designing Your Own Money Management System

By Richard Perlman

When writing your own database, you don't have to be an experienced programmer. You don't have to know about databases, and you don't have to know much about disks. All you must do is read this series of articles and follow the programs as they are explained. If you have read the first article on subroutines, loops and arrays, (January '89, Page 36), you are ready to move ahead to this database which will help you manage your money. This month, let's discuss a new topic: system design.

How to Design a System

System Design is not that difficult to figure out. You begin by deciding what you want your system to do. I want this system to help me manage my money — to keep track of bills and expenses, to make sure I don't run out of cash, and to budget and save for the future. The system must be able to record money coming in, money going out and money that must be paid. It will have to place this information into records and store these records on the disk. (These records will be referred to as deposits, checks and bills.) I must be able to change entries if I make a minor mistake and delete them if I make a major mistake. I will also want to examine the records and run reports about the information stored in them. This is what my system will do, so the first step in the design process has been completed.

Richard Perlman spends his time at work helping others with their PCs. At home, he shares his CoCo 2 with his wife and two children.

But how will it work? I must describe the items of information needed and write this down in a way that will be easy to understand both now and in the future. This is called creating a "Data Dictionary," and this dictionary will be the blueprint for everything else that follows. My Data Dictionary is shown in Figure 1.

Since the items needed for a check, bill or deposit are just about the same, I can put the same items in each record. Each record will have this information in the order shown; therefore, I have formed one of the rules to follow when using this database. I've completed the second design step.

By describing the items I will store in the database, this blueprint tells me what I need to know to construct and run the system. It tells me what each item is, the name I'll use for it in the programs, what type of information it is, where it will appear in each record, and its allowable range of values. Except for the *key* field and the *separator*, all the data items are fully described in this dictionary. Let's examine them.

The first item in my Data Dictionary is the date. I need to know this for each type of record — check, bill or deposit. Next, the record type identifies whether this information refers to a check, bill or deposit. Following the record type, I have included an identifying number. For a check I will use the check number, and for a bill or deposit I will create and use a number for identification purposes.

I also have included in each record an indicator that tells me a transaction has cleared. When you deposit someone else's check or write one of your own, you have to know whether it has cleared your account. If this is a bill record, the indicator will identify whether you have paid the bill. In addition, you must know the amount — anything from $.01 to $999,999.99. Last, but not least, you must record the purpose of the transaction, and who or what else is involved with it.

In the Dictionary there are two references to the *separator*. It is described as `CHR$(127)`. A `CHR$(127)` is a special character that cannot be typed at the keyboard. Insert it at the end of items that will not have the same length in every record. Then you can tell exactly where each item ends. You must use a special character — otherwise you could type the separator in the middle of something and cause the computer to process the information incorrectly. It is no problem to create this special character, and you can choose from many. The following program generates special characters for you:

```
100 CLEAR 500:CLS
120 FOR I= 49 TO 132
130 PRINT @64,"I EQUALS ==> ";I
140 A$= CHR$(I)
150 PRINT "THIS DISPLAYS AS ==>";A$
160 FOR J= 1 TO 250:NEXT J
170 NEXT I
180 GOTO 120
```

I used the `CHR$` instruction on Line 140 to create characters. Some were special, and some were not. If you want to see the possible range of characters, change Line 120 to vary `I` from 1 to 255. Some special characters do not print at all, others produce strange shapes, and still others are letters and numbers. Of all the characters, I chose `CHR$(127)` as my separator because it is dark and has a pointer in it, which makes it easy to spot if I have to look directly at my data. Line 160 adds a pause to the program, so the display doesn't change too quickly for the eye to follow.

Description/Program ID	Key	Type	Length	Range
Date/`CD$`	Yes	Number	4	mmdd: *mm=01-12* dd=01-31
Record type/`TP$`	Yes	Alpha	1	c,d or b c=check d=deposit b=bill
Number/`RN$`	Yes	Number	4	nnnn 9999>nnnn>1000
Cleared/`CL$`	No	Alpha	1	y or n y=cleared n=not cleared
Amount/`AM$`	No	Decimal Number	4-9	nnn.nn
Separator/`SS$`	No	Alpha	1	`CHR$[127]`
To or From/`DS$`	No	Alpha	<=30	characters long
Separator/`SS$`	No	Alpha	1	`CHR$(127)`
Purpose/`CT$`	No	Alpha	<=50	characters long

Figure 1: Data Dictionary

The Data Dictionary identifies that each database record will have *Amount*, *To-or-From* and *Purpose* entries. The Amount entry uses between three and nine characters. The To-or-From entry, describing money's points of origin and destination, can be between one and 30 characters long. The Purpose entry indicates why the money changes hands and can be up to 50 characters long. To figure out when an entry ends, I have placed a separator character between each entry.

Listing 1 shows how this is done. I use the data-entry Subroutine 9020 created last time to enter three items. One of them is a decimal number between 1.00 and 999,999.00. The other two are names of varying length. I use this listing to enter the three items separately, verify that they are in the correct ranges and use separators to combine the items into one record. Next I display the entire record, including the separators, and separate the record into its three original parts.

I used `SS$` to hold the separator character, so I wouldn't have to recreate it each time I needed it. I also used the Subroutine 9020 to control the input. Here are the variables in use at this time:

`P$`:	Holds the input instructions
`SL`:	Holds the screen location
`VT$`:	Identifies the type of input (Numeric Non-Decimal, Decimal with two places or Alphanumeric)
`HV`:	Holds the highest acceptable value
`LV`:	Holds the lowest acceptable value

I built the `NN$` record as I went along, adding to it each time I had some more information (see lines 124, 145 and 165). You might think it is unusual to add characters, such as `C$=A$+B$`, but this is not the same as adding numbers. When you add character variables to one another, you are really tacking the beginning of the next one to the end of the last one. This technique also allows you to place the separator character `SS$` at the correct spot in the record.

In Line 145 I used Variable `NN$` on both sides of the equal sign. This may not make sense, but when the computer sees an equal sign, it reacts by figuring out the value to the right of the sign. Then it sets the left side of the sign to that value.

You have seen the `MID$` instruction before. Here you also show the `LEFT$` and `RIGHT$` instructions (see lines 124, 190 and 240). They are all useful in slicing up and putting together strings of characters. The `INSTR` instruction in Line 180 is new. It identifies where *in* the *str*ing the separator characters are located, so you can then divide `NN$` to reveal its three parts.

In addition to letting you put together and take apart information, the separator character can also be used to save space on the disk. The standard CoCo disk holds about 150,000 characters. There is a limit to the amount of information that can be held on one disk, and the smaller the size of the record, the more records you can fit in the database. For long names I allowed a maximum of 32 characters for both the first and last names. If I didn't use separators and reserve a fixed space of 32 characters for both the first and last names, all records would be about 70 characters. However, in most cases, a name is less than seven characters long, so a lot of space would be wasted. By using separators, you can write records of considerably shorter length no matter what the length of a person's first or last name. I also saved space by not storing the decimal point (see Line 124). You know where it must be, and can recreate a decimal number that is entered.

Next, look at the `LEFT$` and `RIGHT$` statements on lines 190 and 240. The number I-5 in the `LEFT$` statement does the same thing as the expression `LEN(NN$)-1` in the `RIGHT$` statement. It specifies the number of characters to be selected from either the left or right of `NN$`. Using the expression instead of a number is a shorthand coding technique that saves both time and space.

How to Use the Disk

The disk is used like a file cabinet — you can add files and remove them. The actual filing of data is done by the CoCo disk controller. The program sends simple instructions, like `WRITE`, to the controller, and the controller does the complicated things — turning the drive motor and red indicator light on and off, finding information already on the disk, figuring out which parts of the disk are available to write on, and transferring information between the disk and computer memory. Remember: The disk can hold approximately 150,000 characters of information (which is either a lot or a little, depending upon how you use it). Be careful when attaching the controller to your computer. It must not be inserted, removed or adjusted when the computer is on, or you might find yourself with a burned-out controller.

When you use a file folder, you write a description on it. Like file folders, each disk file must have a filename. A filename has two parts, separated by a slash (/) or a period (.). You can use almost any name you want, as long as the left side of the filename is no more than eight characters and the right side no more than three characters. Before using a disk for the first time, you must prepare it for accepting data from the computer system by allowing the controller to write special information on it. This is called *disk initialization*. To initialize, place a blank disk in Drive 0, enter `DSKINI0` and wait. It takes about a minute to complete. This procedure needs to be done only once. A used disk can be reformatted, however, it will erase any information already on the disk so be careful when you use the `DSKINI` command.

You have to open a file cabinet before using it, and before you use a disk file you must open it, too. If your program tries to use a file that isn't open, the controller will stop the program. Therefore, you use an `OPEN` statement to tell the controller the name of the file to be opened. This statement also tells the controller whether it is to read from or write to this file and gives the file a number, so the controller can identify it later in the program. For example, to open the `MARBLES/RED` file for writing (or output), use the following statement:

```
OPEN "O",#1,"MARBLES/RED"
```

To open the same file for reading (or input), use this statement:

```
OPEN "I",#1,"MARBLES/RED"
```

Remember: You can't open a file that is open already.

Reading from or writing to a disk file is not difficult. Listing 2 shows how to write ten records to a file and then read them back. This listing shows you a lot about disk and display operations. Look at the `PRINT` statements in the listing. They are almost all different in format. Some end in a semicolon (lines 110 and 120), which means that after printing, the display position will remain exactly where it is. After displaying the information in a `PRINT` statement that does not end in a semicolon, the computer will display the item on the beginning of the next line. Lines 110 and 140 use the `PRINT @` format, which tells the computer where to start the display, regardless of where the last line ended.

More Disk Operations

The `OPEN` statements in lines 110 and 150 can use the Character Variable `NA$` instead of a filename in quotes. You can use this technique in most disk operations.

The `CLOSE` statements in lines 140 and 190 should be used after you are finished with a file. `CLOSE` is required on Line 140 because you cannot use the same file for both `I` (Input) and `O` (Output) without closing and reopening it. The `CLOSE` statement on Line 140 has a number in it while the one in 190 does not. The `CLOSE` statement without a number will close all files still open. The one with a number closes only the file opened with that number.

The `INPUT` statement in Line 170 reads two data items at a time. Make sure you know just what you are reading when reading a file. Try changing Line 170 to `INPUT #1,IN$`, and see what you get. Now try changing it to `LINE INPUT #1,IN$`. See what I mean about being careful?

Line 210 includes the disk statement `KILL`. This does exactly what you think it does; it *kills* the possibility of using the file again. The controller doesn't actually erase the information. It marks the file as unusable. It then allows new information to be written over that which was killed. However, if no new information was written and you know how to do it, you can *unkill* this file. Don't try it unless you know exactly what you are doing. You will need to know a lot more about how the controller operates than we can go into here. One last point: A file must be closed before you kill it.

When you read files, you won't know how many records each file contains, and this number will change each time you add or delete a record. Fortunately, the disk controller can tell you when we are at the end of a file — no matter how many records the file contains. It does this by setting an end-of-file indicator. You can ask the controller what the value of this indicator is by using the `EOF` (End Of File) statement in our program. The code on lines 160 and 190 was changed to include such a statement and is shown in the following example:

```
160 IF EOF(1) = -1 GOTO 190
170 INPUT #1,IN$,NB
180 PRINT "===> ";IN$;NB
190 CLOSE
```

Make these changes in Listing 2 and rerun the listing.

The program reads the file in the same way, but now you don't have to know the value of `IX` used to create the file. In fact, you can change the value of `IX` in Line 120 to anything you want, and all the records will still be read. Another note of caution: If you don't check `EOF` before you read a record, don't think the controller will save your information. If you read past the end of the file, the controller will stop your program.

What's the Secret?

The secret of the system is really no secret at all. You will use files like the one we created in the example. These are called *sequential* files because the records follow each other in the sequence they were written. When you use the `OPEN` command to create a file, the disk controller finds an unused space on your disk for the file and uses only the space you need. Your program does not have to worry about the file's location on the disk because the controller does this automatically. After you have closed the file, the controller needs to know its name to get it back for you.

A disk file can occupy space on the outside, middle, or inside of the disk. As you add to it, it becomes larger and larger, and although a computer is a fast machine, it will be slowed to a crawl if you force it to start looking at the beginning of an ever-longer file each time you are looking for a particular point in that file. The database will

Listing 1: SEPARATE

```
0 ' COPYRIGHT 1989  FALSOFT,INC
100 CLEAR 500:SS$=CHR$(127)
105 CLS:PRINT "- ENTER, COMBINE, AND SEPARATE -"
110 P$="ENTER A DECIMAL NUMBER":VT$="D"
120 HV=999999:LV=1:SL=64:GOSUB 9020
124 NN$=LEFT$(VA$,LEN(VA$)-3)+RIGHT$(VA$,2)
130 P$="ENTER YOUR FIRST NAME":VT$="A"
140 HV=32:SL=128:GOSUB 9020
145 NN$=NN$+SS$+VA$+SS$
150 P$="NOW YOUR LAST NAME, DON'T BE SHY":VT$="A"
160 HV=32:SL=192:GOSUB 9020
165 NN$=NN$+VA$
167 PRINT:PRINT "---- THE ENTIRE RECORD IS ----"
170 PRINT NN$
180 I= INSTR(1,NN$,SS$):J= INSTR(I+1,NN$,SS$)
185 PRINT:PRINT "---- THE PARTS ARE -----------"
190 NB$=LEFT$(NN$,I-3)+"."+MID$(NN$,I-2,2)
200 PRINT "NUMBER ------>";NB$
230 PRINT "FIRST NAME -->";MID$(NN$,I+1,J-I-1)
240 PRINT "LAST NAME --->";RIGHT$(NN$,LEN(NN$)-J)
250 PRINT:PRINT "TOUCH 'ENTER' TO CONTINUE";:INPUT CT$:GOTO 105
9020 PRINT @SL,P$:PRINT @SL+32," ":PRINT @SL+32,"";
9026 LINE INPUT "==> ";VA$ 'INPUT THE VARIABLE
9028 LA= LEN(VA$):IF VT$= "A" GOTO 9044
9030 VV= VAL(VA$):IF VT$= "D" GOTO 9038
9034 IF INT(VV) <> VV GOTO 9020 ELSE GOTO 9042
9038 IF LA > 9 OR LA < 3 GOTO 9020
9040 IF MID$(VA$,LA-2,1) <> "." GOTO 9020
9042 IF VV < LV OR VV > HV GOTO 9020
9044 IF LA > HV GOTO 9020 ELSE RETURN
```

Listing 2: RITEREAD

```
0 ' COPYRIGHT 1989  FALSOFT,INC
100 CLS:NA$="RECORDS/DAT"
105 PRINT "--- TEN RECORDS ON A FILE ------"
110 OPEN "O",#1,NA$:PRINT @32,"+++ WRITING ===>";
120 FOR IX = 1 TO 10:PRINT " ";IX;
130 WRITE #1,"RECORD NUMBER:",IX
140 NEXT IX:CLOSE #1:PRINT @96,"++++ READING BACK ++++"
150 OPEN "I",#1,NA$
160 FOR IX = 1 TO 10
170 INPUT #1,IN$,NB
180 PRINT "===> ";IN$;NB
190 NEXT IX:CLOSE
200 LINE INPUT "ERASE THE FILE? Y/N ";KF$
210 IF KF$ = "N" GOTO 250 ELSE KILL NA$
250 LINE INPUT "RUN IT AGAIN? Y/N ";MT$
260 IF MT$ = "N" THEN END ELSE GOTO 100
```

Listing 3: TIMER

```
0 ' COPYRIGHT 1989  FALSOFT,INC
1 CLEAR 500:CLS
2 PRINT "-- READ/CALCULATE COMPARISON --
4 OPEN "O",#1,"RECORDS/DAT"
6 A$ = STRING$(150,"X"):FOR ID = 1 TO 20
8 WRITE #1,A$:NEXT ID:CLOSE
10 OPEN "I",#1,"RECORDS/DAT"
20 TIMER = 0
30 FOR ID = 1 TO 20
40 LINE INPUT #1,IN$
```

work much faster if you can split the information into smaller files and find an easy way to see which file you should open when we are looking for specific information.

This is called *indexing*, and it is like using an index in a textbook. With the book, you look in the index for a topic, and the index tells you where to locate the information. In this program, the index will tell you which file to open. Since each of the records contain a date, use the date as an index and put all the information for a group of dates in its own file. Then create an index subroutine that opens the correct file when you give it the date.

Listing 3 gives you an idea how much faster your program will run by using indexing. It uses the internal TIMER of the CoCo to time the operation of reading a disk file. As in Listing 2, the program creates a file (this time, of 20 records), reads the records back one at a time and times how long this takes. It then times the processing of a set of arithmetic instructions for comparison.

Lines 1 to 8 create the file; lines 10 to 50 read the file; and Line 60 tells how long it took to read the records. Line 70 resets the timer to do the comparison. You will see that reading one record from the disk file took longer than executing the lines of code from 90 through 110, including 13 arithmetic instructions and a FOR/NEXT loop. It really is worth the extra effort to index information.

Creation: The Empty Database

The disk controller does a lot of good things, but it will not put more than 72 files on a single disk. This prevents the use of a daily file system because you cannot have 365 files. We could have a weekly system of 52 files, a monthly system of 12 files or a bimonthly system with 24. How about using a weekly system? How would you like to write a program that puts each week's information in the proper month, splitting each week at the month's end and working perfectly well on leap years? I wouldn't, so I discarded the 52-file system. I also didn't want to read through an entire month's data just to find one record, so I discarded the 12-file system. I settled on 24 files, using two files for each month. The first file holds everything from the first to the 15th and the second, from the 16th to the end of the month — whenever that might be. To identify these files as a database, I named them M..D../CHK and wrote Listing 4 to create the empty database.

Run Listing 4 once on an empty or *nearly empty disk.* It creates the 24-file empty database. If you run it again, it destroys any existing database, replacing it with an empty one. To make sure the database is there, you can enter various combinations of months and days to see which file is selected. Be careful: The program will not reject invalid input (December 43, anyone?) and may try to open a nonexistent file. If this happens, the program ends with an NE (Non Existent File) Error, but the database is still there.

The Key to It All

Part of the information of each record in the database serves as its Index Key. This key identifies the record's location on the database. Together with the indexing subroutine, it tells you in which file the record belongs and the location of the record in the file. Listing 5 shows how this is done. It adds records to the database, using one subroutine to open the correct database file and another to add individual records. A database (empty or not) must already be in place on the disk you use.

This program lets you add check records to the database. Option 2 stops the program. To restart it enter `RUN`. You are asked to supply the information required to build the record on lines 380 to 440. After you have typed it in — but before going any further — you are forced to make a final check of the information before you add it (Line 480). You can indicate that it is OK as is or you can change anything you want until you like it. This is one of the additional steps taken to ensure that no garbage gets into the database. After you indicate that the information is correct (Line 520), the program constructs an Output Key, `OK$`, on Line 522 and a Write Record, `WR$` on Line 524.

The output key is that part of the record used to determine where in the database this record is stored. Each record written to a file must have a higher key than the one before it. No duplicate keys are allowed. Therefore, only one record in the entire database can have a key with this information. Part of the key (the date) identifies the file the record will be on. The rest of the key (record type, and record number) tells you where on the file this record is placed.

Subroutine 9070 opens the correct database file, and the Subroutine 9100 adds the record. Later, the 9100 subroutine will be used to change and delete records. If a value of zero is placed into

```
50 NEXT ID
60 PRINT "READING TOOK ";TIMER
70 TIMER = 0
90 FOR ID = 1 TO 20
100 Z = Z + 1: X = X + 2:Y = Z + X
103 W = 3 * Y:V = W - Z:U = 365 * V
106 T = (U+V+W+X+Y+Z)/24.3
107 FOR DD = 1 TO 4
108 S = S+1:NEXT DD
110 NEXT ID
120 PRINT "PROGRAM TOOK ";TIMER
130 CLOSE:END
```

Listing 4: `CREATE`

```
0 ' COPYRIGHT 1989  FALSOFT,INC
100 CLEAR 500:CLS
105 PRINT "-----  CREATE THE DATABASE -----
110 FOR I = 1 TO 12
115 A$= RIGHT$(STR$(I),1)
120 IF I > 9 THEN A$= "1"+A$ ELSE A$= "0" + A$
130 F1$ = "M"+A$ +"D01/CHK"
140 F2$ = "M"+A$ +"D15/CHK"
150 PRINT "CREATE ";F1$;" AND ";F2$
160 OPEN "O",#1,F1$:OPEN "O",#2,F2$:CLOSE
170 NEXT I
175 CLS
180 PRINT:PRINT "DATABASE CREATED LET'S CHECK"
190 PRINT @256,"ENTER THE MONTH 01-12"
200 INPUT MM$
210 PRINT "ENTER THE DAY 01 TO 31"
220 INPUT DD$
230 IF DD$ > "15" THEN FD$="15" ELSE FD$="01"
240 SG$= "M"+MM$+"D"+FD$+"/CHK"
245 CLOSE
250 OPEN "I",#1,SG$
260 PRINT "FILE "SG$" IS THERE":GOTO 190
```

Listing 5: `ADDRECRD`

```
0 ' COPYRIGHT 1989  FALSOFT,INC
50 FILES 3,1000
100 CLEAR 750:DIM LI$(7):SS$=CHR$(127)
150 CLS0:PRINT @0,"--- MONEY MANAGER DATA BASE ---a
200 LI$(1)="1= ADD INFORMATION
203 LI$(2)="2= END SESSION
210 SL=128:NL=2:AD=0:GOSUB 9000
250 ON A GOTO 320,260
260 PRINT @385,STRING$(30,"*");
262 PRINT @417,"SESSION IS OVER - BYE FOR NOW ";
265 PRINT @449,STRING$(30,"*");
266 FOR I=1 TO 1800:NEXT I:CLS:END
320 CLS0:PRINT "--- ADDING INFO TO DATABASE ---b"
321 AD=1:LI$(1)="1= ENTER A CHECK
330 LI$(2)="2= RETURN TO THE FIRST MENU a
340 LI$(3)="3= END THIS SESSION":NL=3
345 SL=128:GOSUB 9000:ON A GOTO 370,150,260
370 CLS0:PRINT @0,"-----  CHECK INFORMATION ------c
375 GOSUB 380:GOSUB 400:GOSUB 406:GOSUB 410:GOSUB 414:GOTO 430
380 P$="1= ENTER THE MONTH:  1-12":LV=1:HV=12:SL=64
390 VT$="N":GOSUB 9020:MM$=RIGHT$("0"+VA$,2):RETURN
400 P$="2= ENTER THE DAY: 1-31":LV=1:HV=31:SL=128
402 VT$="N":GOSUB 9020:DD$=RIGHT$("0"+VA$,2):RETURN
406 P$="3= ENTER CHECK NUMBER: 1000-9999":LV=1000:HV=9999
408 SL=192:VT$="N":GOSUB 9020:CN$=VA$:RETURN
```

```
410 P$="4= ENTER THE AMOUNT: NNNNNN.NN":LV=1.00:HV=999999.99
412 VT$ ="D":SL=256:GOSUB 9020
413 AM$=LEFT$(VA$,LEN(VA$)-3)+RIGHT$(VA$,2):RETURN
414 P$="5= ENTER WHO CHECK WAS PAID TO":SL=320:VT$="A
420 HV=31:GOSUB 9020:CP$=VA$:RETURN
430 P$="6= ENTER WHAT CHECK WAS FOR":SL=384:VT$="A
440 HV=58:GOSUB 9020:CF$=VA$
470 PRINT @0,"---  FINAL O.K.  OR CHANGE ----d
480 PRINT @32,">TYPE 'Y' IF ALL ITEMS ARE O.K.<";
481 FOR I = 1 TO 220
482 A$=INKEY$:IF A$ <> "" GOTO 490 ELSE NEXT I
484 PRINT @32," OR TYPE LINE NUMBER TO CHANGE  ";:FOR I=1 TO 300
486 A$=INKEY$:IF A$ <> "" GOTO 490 ELSE NEXT I:GOTO 480
490 IF A$ = "Y" GOTO 520
500 A = VAL(A$):IF A > 0 AND A <7 GOTO 510 ELSE GOTO 470
510 ON A GOSUB 380,400,406,410,414,430:GOTO 480
520 CLS0:PRINT "------- ADDING THE CHECK ------e"
522 PRINT "     P L E A S E   W A I T":OK$= MM$+DD$+"C"+CN$
524 WR$ = OK$+"*"+AM$+SS$+CP$+SS$+CF$
526 GOSUB 9070:GOSUB 9100:CLS0
530 IF GE =1 THEN PRINT "----  CHECK WAS ADDED    ------f"
ELSE PRINT "** DUPLICATE CHECK NOT AD DED **d
540 LI$(1)="1= ADD ANOTHER CHECK
550 LI$(2)="2= RETURN TO THE FIRST MENU a
557 LI$(3)="3= END THIS SESSION RIGHT NOW
560 SL=96:NL= 3:GOSUB 9000:ON A GOTO 370,150,260
9000 FOR I= 1 TO NL:PRINT @SL,LI$(I)
9001 SL= SL+32:NEXT I
9005 PRINT @32,"*   SELECT FROM THE FOLLOWING
9006 FOR I = 1 TO 200
9007 A$ = INKEY$:IF A$ <> "" GOTO 9012 ELSE NEXT I
9008 PRINT @32," *":FOR I = 1 TO 65
9009 A$ = INKEY$:IF A$ <> "" GOTO 9012 ELSE NEXT I
9010 GOTO 9005
9012 A = VAL(A$):IF A > 0 AND A < NL+1 THEN RETURN
9013 GOTO 9005
9020 PRINT @SL,P$ :PRINT @SL+32," " 'PROMPT
9024 PRINT @SL+32,""; 'REPOSITION
9026 LINE INPUT "> ";VA$ 'INPUT
9028 LA= LEN(VA$):IF VT$ = "D" GOTO 9044
9030 IF VT$ = "N" GOTO 9036
9032 IF LA > HV GOTO 9020
9034 RETURN 'VARIABLE IS IN RANGE
9036 VV= VAL(VA$):IF VV < LV OR VV > HV GOTO 9020
9038 IF VT$="D" GOTO 9034
9039 IF RIGHT$(VA$,1)< "0" OR RIGHT$(VA$,1)> "9" GOTO 9020
9040 IF VV <> INT(VV) GOTO 9020 ELSE GOTO 9034
9044 IF LA > 9 OR LA < 3 GOTO 9020
9046 IF MID$(VA$,LA-2,1) <> "." GOTO 9020
9048 GOTO 9036
9070 IF DD$ > "15" THEN DF$ = "15" ELSE DF$ = "01
9072 SG$= "M"+ MM$+ "D"+ DF$+ "/CHK"
9096 CLOSE:OPEN "I",#1,SG$:OPEN "O",#2,"WORK/CHK":RETURN
9100 IF EOF(1) = -1 GOTO 9130
9105 INPUT #1,LI$:IK$ = LEFT$(LI$,9)
9110 IF IK$< OK$ THEN WRITE #2,LI$ ELSE GOTO 9160
9120 GOTO 9100
9130 ON RA GOTO 9132:ON AD GOTO 9131,9134,9134
9131 WRITE #2,WR$
9132 RA=0:CLOSE:KILL SG$:COPY "WORK/CHK" TO SG$:GE=1:RETURN
9134 RA=0:GE=2:CLOSE:RETURN
9160 IF IK$ > OK$ GOTO 9200: 'INPUT >=OUTPUT
9162 ON AD GOTO 9134,9170,9170  'INPUT =OUTPT
9170 GE=1:RETURN 'CHANGE
9200 ON AD GOTO 9202,9220,9220: 'INPUT > OUTPUT
9202 ON RA GOTO 9210:WRITE #2,WR$:WRITE #2,LI$:RA=1:GOTO 9100
9210 WRITE #2,LI$:GOTO 9100
9220 ON RA GOTO 9210:GOTO 9134
```

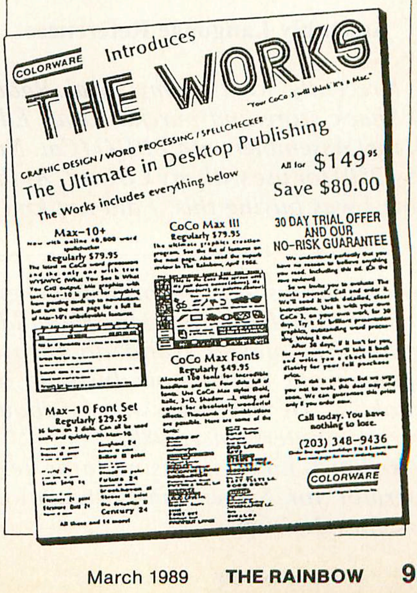
the variable `AD`, the subroutine assumes that you are using it to add a record (`WR$`) with the key (`OK$`).

The detailed working of this subroutine will be explained in the next article. What should be noted here is the way the subroutine uses the `GE` (Good Ending) variable. It is possible that the record to be added (`WR$`) will be added correctly. It is also possible that there will be some problem (such as a duplicate key), and it will not be added. The program must take different action depending upon the result. If the record is successfully added, the subroutine places a value of 1 into Variable `GE`. If there was a problem and the record was not added, then a value of 0 or 2 is placed in the variable. When the subroutine returns control to Line 530, the program tests the value of `GE` to determine which message to display. You can then add more records or stop the program.

That's all for this month. By now you know a good deal about how to use your disk. [For more detailed information on disk operation, see Bill Barden's "Delving Into the CoCo Disk" (January '88, Page 180).] In the the next article, I'll go into more detail about the 9100 subroutine and show you the complete program, which adds, deletes and changes both checks, deposits and bills. See you next time.

(Questions or comments about this tutorial may be directed to the author at 83-34 169 Street, Jamaica, NY 11432. Please include an SASE when requesting a reply.)

Real Desktop Publishing with
THE WORKS. See page 19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DOCTOR Q&A ASCII

By Richard E. Esposito
Rainbow Contributing Editor
with Richard W. Libra

Losing the Picture

I have a 128K CoCo 3 with an FD 502 disk drive. I am having problems saving `HSCREEN 2` *pictures to disk and loading them back into BASIC. I use* `SAVEM "filename", 3584,9727,3584` *to save them. To reload, I use* `LOADM "filename":POKE &HE6C6,&HSCREEN 2`*, but this process doesn't work. It will reload properly right after being saved, but after I re-power the computer, I get nothing but garbage. Can you help?*

Cory Burgess
Tullahoma, Tennessee

℞ You are having problems because BASIC is using more than 64K by bank switching in the `HSCREEN` memory when it is needed and then switching it out when it is not. The following two BASIC programs allow you to save and load `HSCREEN` images:

HISAVE

```
10 INPUT"NAME:;"N$
20 FOR I=&H70 TO &H73
30 POKE &HFFA2,I
40 F$=N$+"/HR"+CHR$(I-64)
50 SAVEMF$,&H4000,&H5FFF,44539
60 NEXTI
70 POKE &HFFA2,&H7A
```

HILOAD

```
10 INPUT"NAME:;"N$
20 INPUT"HSCREEN#;"H
30 HSCREEN H
40 FOR I=&H70 TO &H73
50 POKE &HFFA2,I
60 F$=N$+"/HR"+CHR$(I-64)
70 LOADMF$
80 NEXTI
90 POKE &HFFA2,$H7A
```

Assembly Language References

I recently went to my local Radio Shack store and purchased an Editor/Assembler with ZBUG (Cat. No. 26-3250) for use with my CoCo 2. At the time I was buying this, I did not know that this product had been discontinued. After I got it home, I started reading the manual and found it would not teach me how to program in assembly language. The manual referred to a book (Cat. No. 62-2077), which would teach me this. I returned to Radio Shack only to find that the book had been discontinued as well, and there was no possible way for me to get a copy of it. Could you suggest a place where I can purchase this book? If not, could you recommend another book that would serve the same purpose?

Chay Wesley
Danville, Kentucky

℞ The best source for technical information on assembly language is *6809 Assembly Language Programming*, by Lance Leventhal, Osborne/McGraw-Hill ($16.95, 562 pages). Three other assembly language references are: *Assembly Language Graphics for the TRS-80 Color Computer*, by Don Inman, Reston ($14.95, 280 pages); *The MC6809 Cookbook*, by Carl Warren, TAB Books, Inc. ($6.95, 162 pages); and *Programming the 6809*, by Rodnay Zaks, Sybex ($14.95, 362 pages). Also, see the ad for Tepco in this issue.

Richard Esposito is the principal engineer for BDM Corporation. He holds bachelor's, master's and doctorate degrees from Polytechnic Institute of Brooklyn. He has been writing about microcomputers since 1980.

Richard Libra is a simulator test operator for Singer Link Simulation Systems Division.

Pascal Problems

I recently purchased a copy of OS-9 Pascal *Version 2.00 for use with OS-9 Level II. After creating a short source program, I attempted to direct it to the computer. I received a Pascal Error 203, or OS-9 File Error, followed by an OS-9 Error 216 (pathname not found). I got the same result when I tried to compile the sample program included on the disk. What pathname is the compiler looking for? Isn't this package compatible with Level II?*

Jonathan Roorda
Holland, Michigan

℞ Thanks to Greg Law for the following information: In the program *Pascal*, there is a minor bug in the specification of the access mode for the open calls of the two files `Pascal-Compiler` and `PascalErrs`. As distributed, those two files are in the execution directory. When *Pascal* opens those two files in the `READ` mode, it attempts to locate them in the current `DATA` directory. The following patch changes the access modes of the open calls to `EXECUTE+READ`, so they are correctly located in the current execution directory.

```
load pascal
modpatch -s
l Pascal
c 0697 21 25
c 1692 21 25
v
```

After the patch is made, use the Level I `Save` utility, which is Level II-compatible, to put the patched version of *Pascal* on disk.

Keep It Accessible

Some time ago RAINBOW *had an article that explained how to keep a Multi-Pak Interface and a CoCo together by attaching them to a board. The cases are screwed together at the bottom, so how do you get the cases back together after they are secured to the board?*

Joseph J. Diovanni
Laurence Harbor, New Jersey

℞ Drill access holes in the board to get at the screws.

A Drive Patch

I read your September '88 column (Page 138). I can add a bit to your response to the person unable to access double-sided drives with the TW-80 Telewriter *patcher under ADOS-3.* TW-80 *must be configured to work with double-sided drives. (Unpatched* Telewriter *works fine with double-sided drives.) There is provision for this in* TW-80*'s configure program,* `CONFIG.BAS`*. However, Doug Masten, the author of* TW-80*, told me he chose not to "officially" support double-sided drives because he had none of his own and was unable to test this feature properly. To get* TW-80 *to recognize double-sided drives (with or without ADOS-3), look at the following in* `CONFIG.BAS`*:*

```
350 GOSUB 3890:D0=A 'disk drive se-
lect table
360 GOSUB 3890:D1=A
370 GOSUB 3890:D2=A
380 GOSUB 3890:D3=A
```

For double-sided drives, change `D2=A` *to* `D2=&H41` *and* `D3=A to D3=&H42` *in lines 370 and 380. This makes the program recognize Drive 2 as the back side of Drive 0 and Drive 3 as the back of Drive 1. After making these changes, run* `CONFIG.BAS` *to save the configuration file that lets* TW-80 *recognize the double-sided drives from then on.*

Art Flexser
SpectroSystems

℞ Thanks for the information.

Changing Terminals

Is it possible to hook my Televideo 910 terminal to my CoCo via OS-9 Level II `/t2`*? My system includes an MPI and a Deluxe RS-232 pack.*

Bert A. Challenor
Albuquerque, New Mexico

℞ On each of two DB-25 connectors, wire pins 4, 5 and 8 together. Do the same with pins 6 and 20. Then, using a three-wire cable, wire Pin 7 (ground) on one DB-25 to Pin 7 on the other DB-25. Connect Pin 2 (transmit) on one DB-25 to the wire on Pin 3 (receive) on the other DB-25. Wire Pin 3 on the first DB-25 to Pin 2 on the second, so you can transmit and receive in both directions.

Only Your Vendor Knows

I have a Tandy FD 501 disk drive. Will any half-height drive work as a second drive? How hard is a second drive to install? If I expand my CoCo 2 to 128K, how would I use the extra memory as a print spooler or RAM disk? How would I get my CoCo to auto-boot a program when I power up? Is there a Color Computer equivalent to MS-DOS's `autoexec.bat`*? Also, how can I transfer ML programs from tape to disk if I don't know the start, end or exec?*

Albert Noah

℞ Using the extra 64K of memory on an upgraded CoCo 2 requires special software to use it as a RAM disk. J&R Electronics supplies this software with its Banker CoCo 2 memory upgrade. Since memory beyond 64K on a CoCo 2 was never officially supported by Tandy, those upgrades from various manufacturers all work differently, hence each CoCo 2 upgrade requires its own vendor-specific software.

Direct Access in Disk BASIC

How do you locate and change the sequence of bytes of VIP Calc*, so it will work on a CoCo 3?*

Lionel Boucher
Mont Saint-Hilaire, Quebec

℞ Any BASIC file including machine language files can be read and written to as direct access files in Disk Color BASIC. Set the record length to one byte. Then a simple BASIC program can loop through all the bytes that make up the program and rewrite the new bytes when the proper sequence is found.

Looking for a Common Sequence

I have RGB Patch *by Spectral Associates, and I use it with my CM-8. When I load* One-On-One*, the opening screen is in color, but after the game loads and begins, it goes to black & white. How can this be fixed to display color? The patch seems to work fine with other games.*

Jeff P. Szczerba
Sturtevant, Wisconsin

℞ *RGB Patch* is a program that looks for common sequences of bytes that denote `PMODE 4` in machine language. It then changes them to a sequence of bytes that denote `PMODE 3`. If a program uses a sequence of bytes that the author did not anticipate, the program will not be fixed. The only alternative in such a case is to disassemble the code, analyze it and come up with your own custom fix on a case-by-case basis.

To Upgrade or not to Upgrade

What advantages are there in upgrading to the latest versions of Burke & Burke's hard disk software drivers?

Joe Schmitz
Detroit

℞ The upgrade to Version 2.3 lets you run two different-sized hard drives and does a much better job of reporting errors. It also turns off automatic retries during formatting, so it will lock out more marginal sectors during the verify pass. The best thing about Version 2.3 is that it includes *EZGen*, a handy boot-file editor. *Hyper-I/O* 2.5 is CDOS-compatible. However, on a CoCo 3 CDOS system, there is a problem in the startup message. There will probably be a *Hyper-I/O* 2.6 that corrects this and eliminates the limit on MSA size for drives 2 and 3. *XT-ROM* 2.3 does not require any jumpers on the controller or any special `DEBUG` patches to the boot module, and it has a version of *Life* that you can actually play instead of just watching.

Changing Levels

Is there a quick fix to get DynaCalc *to run on the CoCo 3? It's a great program, but it hangs up when I try to run it on my CoCo 3.*

Al Bilinski
Selkirk, Manitoba

℞ If you have the OS-9 version, copy it over to an OS-9 Level II disk. The OS-9 Level I boot that came with the program is not CoCo 3-compatible.

For a quicker response, your questions may also be submitted through RAINBOW's CoCo SIG on Delphi. From the CoCo SIG> prompt, pick Rainbow Magazine Services, then, at the RAINBOW> prompt, type `ASK` for "Ask the Experts" to arrive at the EXPERTS> prompt, where you can select the "Doctor ASCII" online form which has complete instructions.

New commands, virus demonstrations and more on Delphi

What's Goin' On?

By Don Hutchison
Rainbow CoCo SIG
Database Manager

For the last few weeks, we've been really active on the Delphi SIGs, and many things have been happening online. We've changed some commands, developed a virus (don't worry, it's not contagious), and added a Delphi terminal program. Let me give you a few details.

New Database Commands

The `UPLOAD` and `DOWNLOAD` commands have been changed. These commands formerly applied only to text files, but now you can choose from several file transfer methods, which work with both text files and other kinds of files. Use the `UPLOAD` command to upload a file and the `DOWNLOAD` command to download a file. If you want to use a method of file transfer different from the one you usually use, you can type `UPLOAD MENU` or `DOWNLOAD MENU`. You can also use one of the commands not visible on the Workspace menu.

`UPLOAD` and `DOWNLOAD` display menus of file transfer protocols. To upload or download the way these commands used to work, select Buffer Capture as your protocol. You can make this file transfer method a permanent selection by following the instructions shown after completing a successful transfer. Once you have done that, type `UPLOAD MENU` or `DOWNLOAD MENU` if you want to change your mind. For a brief explanation of other file transfer protocols available, type `OTHER` at the WS> prompt.

Uploading Files to the CoCo SIG

Uploading to the database of a SIG consists of a two-step process: First upload the file to your workspace, then submit the file to the staff of a given SIG for publication. You can reach your workspace from the CoCo Sig> prompt or from within the database by typing `WO`. You can reach it from any SIG on Delphi. Once in your workspace, tell Delphi you want to upload a file using the Xmodem, Ymodem or Kermit protocol. (Naturally, your terminal program must also support the file transfer protocol you use.)

To upload using Xmodem, type `XUP`; to use Ymodem, type `YUP`. Use `KUP` for a Kermit upload or `KERMIT` to invoke the Kermit server. Using `HELP` and the question mark (?), you can find more information about this. You can also set up your default settings to a specific file transfer protocol and modify other file transfer parameters. You will be prompted by Delphi for a filename, and you'll be asked whether or not the file is a text file. If you are uploading BASIC programs to Delphi, please make sure you have already saved them to tape or disk in ASCII format in this manner:

```
(C)SAVE "filename",A
```

After you answer the prompted questions, Delphi will tell you to begin sending your file, and it will wait for your upload. Initiate the file transfer sequence (which will be found in the instructions for the terminal program you're using). You can upload as many files as you like by following this procedure repeatedly.

When all the files you want to submit are in your workspace, you are ready to submit the file or files to the SIG. To do this, you must be in that SIG. From your workspace or from the DBASES> prompt, enter the `SUBMIT` command. You'll be asked for the number of files in the group you want to publish. Identify the number. Delphi has a tree-structured database, where sets of files (e.g., programs and documentation)

Don Hutchison is an electrical engineer and lives in Atlanta, Georgia. He works as a senior project engineer involved in the design of industrial control systems. On Delphi, Don is the Database Manager of the RAINBOW *CoCo SIG. His Delphi username is* DONHUTCHISON.

Database Report

The holiday rush is over and the New Year is off to a great start. We've gained many new CoCo users because of gifts, and the uploading activity has been great on Delphi. Let's look at what's new on the Rainbow SIGs.

OS-9 Online

In the General topic of the database, **Paul Ward** (PKW) sent us the start of a new OS-9 "buglist." **Jay Truesdale** (JAYTRUESDALE) uploaded a text file describing a new bus-based system from Frank Hogg Laboratories, and **Keith Alphonso** (ALPHASOFT) posted a text file containing various notes about BBS operation. Finally, **Mike Stute** (GRIDBUG) sent us some notes on computer viruses.

The Applications topic brings us **Chris Burke** (COCOXT), who uploaded a fix for auto-linefeed printers under the *RSB* operating system. **John Barrett** (JBARRETT) sent us a program for designing highway curve layouts, and **Don Thrash** (DONTHRASH) posted his `DS.INIT.MAKER` file.

In the Utilities topic, **Warren Moore** (WJMOORE) uploaded a utility to strip leading/trailing spaces from a text file and a utility to strip any column range from a printer. While **John Beveridge** (JOHNTORONTO) sent us a program to help keep disks virus-free, **Greg Jandl** can be grouped together.

Once this is finished, you'll be prompted for a description of the file's or files' purpose. (A note of the filenames should be in your Workspace when you upload them.) You must specify an extension for all files submitted to the CoCo SIG. Just as CoCo Disk BASIC uses filenames and extensions, so does Delphi. You will now be prompted for other information as the procedure continues. You'll be asked for the name of each file and the name you want them to bear when seen by the public. After the submission process is over, the files will appear as a group in a place visible to the SIG staff, who will review them and then make them visible to the public. Delphi will also thank you for your submission. During the submission process, you will be asked if you want to have the file in your workspace deleted. I suggest you answer no until the submission is complete and published — then delete the files from your workspace. If you are interrupted for any reason and bounced offline, the submission process will be terminated, and you'll have to upload the files that have been deleted again. (Call waiting is a common example of such an interruption.)

Please do not submit files to the SIG that you also intend to submit to RAINBOW for possible publication. Once a program is published online, it can't be accepted by THE RAINBOW. The single exception here would be CoCo Gallery pictures.

Naturally, programs and material that have a copyright can be published online only with the owner's permission. *MikeyTerm* is an example of such a program that is available on Delphi with the author's permission. However, a program such as *V-Term* would not be acceptable online because it has a copyright and is distributed commercially.

More About Viruses

Delphi CoCo SIG members are developing our own, special virus online. This is something new and interesting to many users because the CoCo's ROM-based operating system is more virus-proof than other systems.

However, **Steve Bjork** (6809ER) reports that while "a true virus cannot be placed in a ROM system, you can have a virus that replicates itself from disk to disk." Steve also mentioned that he's writing a demonstration program, which will enter the *CoCo's* system inside a program and hide until a write is done to the directory track. At that point, it will reformat Track 17 to put another virus on the disk that automatically introduces a new virus into the system any time the user enters the `DIR` command or loads a file. Naturally, Steve's code is intended only for demonstration purposes and will not cause any damage or disruption to a user's system. Further, Steve comments, "Because of the way the new virus is placed on Track 17, you can make a backup without spreading it. In other words, you can cure a virus-infected disk by making a backup of it."

All of us on the CoCo SIG are looking forward to seeing Steve's demonstration program. (Interested users may follow the thread starting with Forum Message #46032 for further details and more specific information.) This demonstration could help us learn more about protecting ourselves from viruses. Thanks, Steve.

In spite of intense media attention,

Alpha Software Technologies

OS9 Level II BBS Release 2.0

The best BBS system has just gotten better! System comes complete and ready to run in less than 5 minutes! Use the built in menus or create your own, you can even run your own programs or games on-line! Complete message system allows easy message posting and retrieving. Complete file transfer system supports Xmodem and Ymodem as well as keyword searching single line and paragraph file descriptions. System runs completely in the background, allowing you full use of your computer! Also comes with it's own Terminal program "Quikterm" Free!
512k OS9 Level II and RS-232 Pak Required........$29.95

The Zapper

This wonderful utility allows you to patch anything! Patch commands directly on the disk and fix CRCs automatically! Even allows you to patch the OS9boot file without making a new boot disk! Save files that have been lost or deleted! Fix crashed disks! Hundreds of uses!
64k OS9 Level I or II required........$19.95

Disk Manager Tree

This versatile utility will make your OS9 life a breeze! No more will you have to fight with complicated directory structures. No more searching for files and typing long path names. All of this is displayed using windows. A tree window allows you to change, create, and delete directories quickly. A files window allows you to copy, view and delete files easily. Perfect for the OS9 beginner! Multi-Vue compatibility makes it perfect for Multi-Vue users!
512k OS9 Level II Required........$29.95

Level II Tools

Finally OS9 life becomes easy! With these great utilities you'll be using OS9 like a pro! Complete wildcard commands make file manipulation simple and easy! Tree commands make directory manipulation a breeze! Windowing utilities make changing colors and creating and maintaining windows a snap! Many other useful utilitiies make your OS9 life more pleasant! 25 great utilities for only $24.95, thats less than $1.00 per utility!
128k OS9 Level II Required........$24.95

Warp One

Finally a complete OS9 Level II windowing terminal that you can afford! The program's many features include Auto-dial, Auto-macro, File transfers, buffer capture, on-line timer, chat-mode and much, much more! Menu and dialog windows make it super simple to use! All you'll ever need in a terminal program! Comes complete with ICON for Multi-Vue compatibility.
512k OS9 Level II and RS-232 Pak Required........$34.95

Multi-Menu

Easily create your own pop-down menus with this great utility! No programming experience neccessary! With this utility you can run any OS9 command or program from a menu. Menu creation is super-simple and super easy! Actually see the menu as it develops. A must for any Multi-Vue user!
512k OS9 Level II and Multi-Vue required........$19.95

Send check or money order to: Alpha Software Technologies
P.O. Box 16522
Hattiesburg MS. 39402
Or call: (601) 266-2773

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FILE TRANSFER UTILITIES

XXX: Reviews - December Rainbow   Dale Puckett - November Rainbow. XXX

The GCS File Transfer Utilities provide a simple and quick method to transfer text and binary files from and to a variety of floppy disk formats.

Need to transfer files to and from PC (MSDOS), RSDOS, FLEX and MINI-FLEX disks on your OS-9 system? Have text files on a PC (MSDOS) system at work and want to work on them at home? Have source programs (BASIC, C, Pascal, etc.) which you wish to port to another system?

With GCS File Transfer Utilities, just place the PC (MSDOS), RSDOS, FLEX or MINI-FLEX disk into you disk-drive - enter a simple command and the file is copied into a OS-9 file. File transfer back is just as simple. With Multi-Vue version, just select command from one of three menus.

PCDIR	directory of PC disk	RSDIR	directory of RSDOS disk
PCDUMP	display PC disk sector	RSDUMP	display RSDOS disk sector
PCREAD	read file from PC disk	RSREAD	read file from RSDOS disk
PCWRITE	write file to PC disk	RSWRITE	write file to RSDOS disk
PCRENAME	rename PC file	FLEXDIR	directory of FLEX disk
PCDELETE	delete PC file	FLEXDUMP	display FLEX disk sector
PCFORMAT	format PC disk	FLEXREAD	read FLEX file
		FLEXWRITE	write file to FLEX disk

Extensive options Single, double sided disks. Single, double density disks. 35, 40 or 80 track floppy drives. 8 or 9 sectors (PC). First level sub-directories (PC). Binary files. Use pipes for direct and multiple transfers.

Requires OS-9. 2 drives (one can be hard or ramdisk). Multi-Vue for Multi-Vue version. SDISK (SDISK3 for COCO III).

GCS File Transfer Utilities for CoCo - Multi-Vue version $54.95
- Standard version $44.95

SDISK or SDISK 3 $29.95

Standard diskettes are OS-9 format (5.25") - add $2.50 for 3.5". Orders must be prepaid or COD. VISA/MC accepted. Add $1.75 S&H, COD is additional.

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(603) 464-3850

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MS-DOS is a trademark of Microsoft Corp. FLEX is a trademark of TSC, Inc.

viruses are still very rare. However, viral-protection programs may also serve as disaster-prevention programs. In other words, they might keep you from accidently reformatting a disk. They might also protect you from a program with a conventional bug or from some hardware glitch fouling up your file-allocation table. This side benefit could be more important than the intended purpose of vaccine programs.

DelphiTerm Now Available

Rick Adams (RICKADAMS) has released *DelphiTerm.* Previously called *RickeyTerm*, this data communications package runs on the Tandy Color Computer 3. You need a Color Computer 3, disk drive and modem to run *DelphiTerm.* A printer, a Deluxe RS-232 Pak and a color monitor would be very useful, but are not essential.

Users of *RickeyTerm* will note that *DelphiTerm*'s new features include automatic log-on to Delphi, Ymodem downloading and printer support for RS-232 pack owners. *DelphiTerm* and its supporting files are available for downloading in the Telecommunications topic of the database.

I hope you'll join us in the fun and excitement online on Delphi, and I'll see you next month. ☐

(DAMIONGREY) posted a directory utility supporting wild cards, and **Zack Sessions** (ZACKSESSIONS) sent a Unix-like word-count utility. **Marc Genois** (MARCGENOIS) sent in a program for loading script files into memory as you do a module.

The Patches topic includes **Mike Sweet** (DODGECOLT), who sent a patch for the Disto hard drive that corrects a bug in the interrupt handling, and **Gary Lynch** (GARYLYNCH), who uploaded a patch for *King's Quest 3* that fixes the monitor bug. In addition, **Dave Archer** (DAVEARCHER) posted his patch for *DynaCalc* to work in a 105-column graphics window, and **Karl Quinn** (QKQ) uploaded a patch for Epson printers using *PhantomGraph.* Finally, **Jim Johnson** (REINDEER) sent in a descriptive text file concerning porting *Multi-Vue* to a hard disk.

In the Telcom topic, **Bill Brady** (OS9UGED) posted `WIZZERO2.CCB`, `WPXMOD16.CCB`, `WIZCONFIG 1.2` and `WIZCONFIG 1.2/COCOBIN`. These files are for use with *The Wiz.* **Michael Schneider** (MSCHNEIDER) uploaded the *OSTerm* package, and Keith Alphonso uploaded *QuikTerm.*

Graphics & Music has **Steve Clark** (STEVECLARK) uploading a graphics-clock program written in C. **Glen Hathaway** (HATHAWAY) posted two music files for *UltiMuse*, and **Kevin Darling** (KDARLING) uploaded a *MAX9* paint program. While Warren Moore uploaded a program for displaying artifact colors on an RGB monitor, **Mike Knudsen** (RAGTIMER) posted several new files for *UltiMuse* and a documentation file describing how to construct a simple, inexpensive cable to hook your CoCo to a MIDI synthesizer. **Andy Duplay** (KB8BMN) uploaded VEF pictures of the *Mona Lisa* and Samantha Fox.

In the Programmers Den, **Merle Kemmerly** (TOOK3) sent the C source code for a `procs`-like utility. Zack Sessions posted a Tic-Tac-Toe game, and Mike Stute posted some D&D hints and tips.

CoCo SIG

In the General topic, **Marty Goodman** (MARTYGOODMAN) posted two extensive articles about October's RAINBOWfest. Marty also posted a text file describing the future of the CoCo 3. **Jerome Kalkhof** (GRUMCLUB) posted some further thoughts on the future of the CoCo 3.

I posted the CoCo Gallery pictures for the months of November and December in the CoCo 3 Graphics topic of the database. **John Malon** (JOHNLM) sent us a picture of Madonna and another picture of King Tut in Atari ST format. **Richard Gonzales** (DRIFTY) sent us a digitized picture of Mr. Spock from *Star Trek*, and **Richard Trasborg** (TRAS) posted more famous women as characterized by Mike Trammell. While **John Lancas** (DUSTIN) sent digitized pictures of Marilyn Chambers and *ET*, **Jim Tatarka** (TATARCOCO) sent *The Creature* and *Bambi* (what a combination!). **Howard Rouse** (HOWARDC) sent two pictures drawn using *The Rat*, and **Donald Ricketts** (STEVEPDX) posted a 16-level patch for *MAX-10*'s *PixTran* program.

In Utilities & Applications, **Eric Parish** (ERICPAR) uploaded his *Mandelbrot Numbers* program and an interesting astronomy program. **Ken Halter** (KENHALTER) posted a utility for searching BASIC programs, and **Donald Jereczek** (DONJERE) posted his program for tracking school grades. **Alan DeKok** (ALANDEKOK) sent his fine custom CoCo BASIC programs, and **Roger Carlson** (PERCH) sent us several programs for statistical analysis. Zack Sessions sent us his video library catalog program while **Marc Genois** (MARCGENOIS) sent a spooler program for the CoCo 3.

The Hardware Hacking topic gives us Terry Blackwell posting a collection of software for the Green Mountain Micro EPROM burner, and the Games topic includes Eric Parish posting his Checkers game, and Zack Sessions with a *Star Trek* game for the CoCo 2 and 3.

In the Classic Graphics topic, **Steven Imlay** (SIMLAY) uploaded some Atari pictures he had converted into RLE format, and I posted the CoCo Gallery pictures for the months of November and December.

In the Music & Sound topic, **Lester Hands** (LHANDS) provided *CM3Demo*, a demonstration of a MIDI sequencer program soon available commercially. Lester also uploaded *LMRDemo*, a MIDI recorder program. Mike Stute posted his "Classical Breakdown" and "Inside" by Van Halen. **John Sebella** (FORBIN1) sent a sample of the music from *Star Trek* and a simple waltz.

The Archives topic presents Polls Manager **Dick White** (DICKWHITE), who published twelve new archived polls from the CoCo SIG's Polls section.

In the Data Communications topic of the database, **Ernest Schwaegerl** (PENROSE) uploaded a set of weather images for use with WEFAX, and **Rick Adams** (RICKADAMS) uploaded *DelphiTerm*, his latest version of the popular *RickeyTerm* program. Watch for new versions as Rick adds special graphics abilities to this version. See you next month.

GOOD NEWS

If you own Telewriter, VIP Writer, Word Power, or Textpro, you can upgrade to Max-10 for only $49.95
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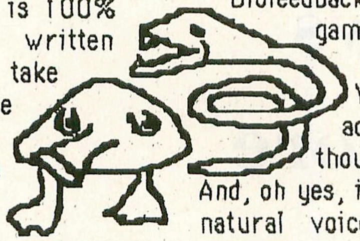
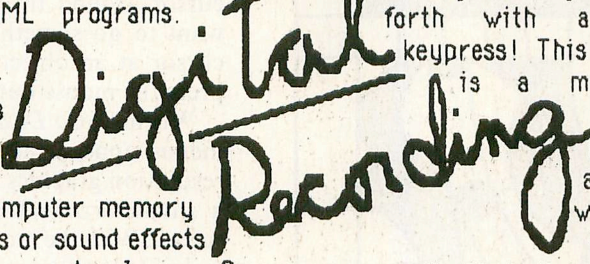


This fascinating CoCo 3 game continues to be one of our best sellers. **Pyramix** is 100% machine language written exclusively to take advantage of all the power in your 128K CoCo 3. The Colors are brilliant, the graphics sharp, the action fast. Written by Jordon Tsvetkoff and a product of **ColorVenture.**

The Freedom Series

Vocal Freedom

I've got to admit, this is one nifty computer program. **Vocal Freedom** turns your computer into a digital voice recorder. The optional **Hacker's Pac** lets you incorporate voices or sounds that you record into your own BASIC or ML programs. This is not a synthesizer. Sounds are digitized directly into computer memory so that voices or sound effects sound very natural. One "off-the-shelf" application for Vocal Freedom is an automatic message minder. Record a message for your family into memory. Set Vocal Freedom on automatic. When Vocal Freedom "hears" any noise in the room, it plays the pre-recorded message! Disk operations are supported. VF also tests memory to take advantage of from 64K up to a full 512K. Requires low cost amplifier (RS cat. #277-1008) and any microphone.



Mental Freedom

Would your friends be impressed if your computer could read their minds? **Mental Freedom** uses the techniques of Biofeedback to control video game action on the screen. Telekinesis? Yes, you control the action with your thoughts and emotions. And, oh yes, it talks in a perfectly natural voice without using a speech synthesizer! Requires Radio Shack's low cost Biofeedback monitor, Cat. #63-675.

BASIC Freedom

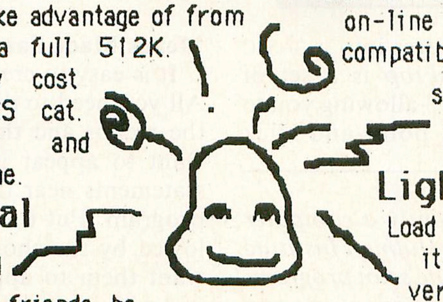
Do you ever type in BASIC programs, manually? If you do, you know it can be a real chore. **Basic Freedom** changes all that. It gives you a full screen editor just like a word processor, but for BASIC programs. Once loaded in, it is always on-line. It hides invisibly until you call it forth with a single keypress! This program is a must for programmers or anyone who types in programs. By Chris Babcock and a product of **ColorVenture.**

Lightning Series

These three utilities give real power to your CoCo 3.

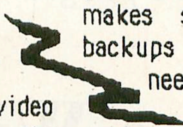
Ramdisk Lightning

This is the best Ramdisk available. It lets you have up to 4 mechanical disk drives and 2 Ram drives on-line and is fully compatible with our printer spooler below



Printer Lightning

Load it and forget it--except for the versatility it gives you. Never wait for your printer again! Printer runs at high speed while you continue to work at the keyboard!

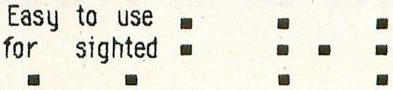


Backup Lightning

This utility requires 512K. Reads your master disk once and then makes superfast multiple disk backups on all your dirves! No need to format blank disks first! Supports 35, 40 or 80 track drives.

COCO Braille

Produce standard grade 2 Braille on a **Brother** daisy wheel printer. Easy to use for sighted or blind user. No knowledge of Braille is necessary. Call for free sample.



Prices

CoCo 3 only

Ram Disk Lightning, Disk	$19.95
Printer Lightning Disk	$19.95
Backup Lightning, Disk	$19.95
All three, Disk	$49.95
Pyramix, Disk	$24.95

CoCo 1,2, or 3

Vocal Freedom, Disk	$34.95
Vocal Freedom Hackers Pac	$14.95
COCO Braille	$69.95

CoCo 2 or 3 only

Mental Freedom, Disk	$24.95
Basic Freedom, Disk	$24.95

CoCo 1 or 2 only

VDOS, The Undisk, ramdisk for the CoCo 1 or 2 only, Tape	$24.95
VDUMP, backup Undisk files to single tape file, Tape	$14.95
VPRINT, Print Undisk directory, Tape	$9.95

Add $2.50 shipping/handling in USA or CANADA
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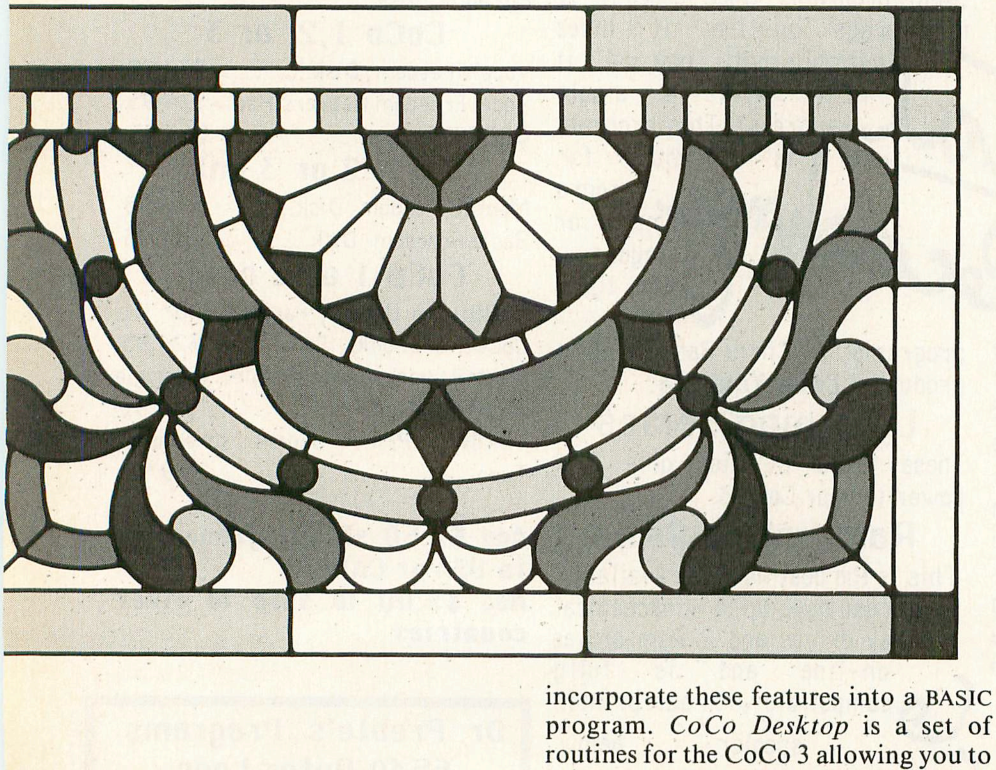
Add a point-and-click interface, complete with windows and pull-down menus, to your BASIC programs

CoCo Does Windows and a Whole Lot More

By Tony Zamora



Recently commercial programs such as *CoCo Max*, *Lyra* and *Multi-Vue* have introduced the CoCo Community to the power of pull-down menus, pop-up windows and a point-and-click user interface. However, we have had no easy way to incorporate these features into a BASIC program. *CoCo Desktop* is a set of routines for the CoCo 3 allowing you to add the power of a point-and-click interface, complete with windows and pull-down menus, to your own BASIC programs.

Tony Zamora is currently a computer science major at Rose-Hulman Institute of Technology. When he's not programming, Tony enjoys reading, music and distance running.

Just Point and Click

A point-and-click interface allows users to work the way they think. Instead of remembering long commands or cryptic control codes, users use a mouse (or joystick) to move a cursor around the screen. When they want to do something, they point the cursor at an object on the screen and press the mouse button.

When *CoCo Desktop* is run, a list of menus appears at the top of a high-resolution graphics screen. You will see a small, arrow-shaped cursor on the screen. With the mouse plugged into the right-joystick port, move this cursor onto one of the menu titles and press the mouse button. A list of menu choices will pop up, and you will be able to select one of the items by moving the arrow up and down the menu. When you select an item, it is highlighted in reverse video. To choose the highlighted option, release the button. If you release the button when no option is highlighted, no selection is made.

Menus Made Easy

It is easy to create your own menus. All you need to do is put the names of the menus and the list of options you want to appear in the menu in `DATA` statements near the beginning of your program. Put the menu title first, followed by the choices in the order you want them to appear. The list should end with a special choice called `END` (all uppercase). For example, if you wanted to create an Option menu containing the choices Send, Receive, Clear Buffer and Baud Rate, you would write a line like the following:

```
100 DATA Options, Send, Receive,
Clear Buffer, Baud Rate, END
```

After the last menu has been put in a `DATA` statement, you need to denote the end of the menus with another `DATA` statement containing only `END`.

You can use two special options when creating menus. The first separates menu choices with a dotted line. To do this, enter a hyphen as one of your menu options, so it appears between the two choices you want separated. This feature is useful when you want to group a set of choices together or isolate an option. If you want the options Send and Receive grouped together in the menu, the `DATA` statement appears as follows:

```
100 DATA Options, Send, Receive, -,
Clear Buffer, Baud Rate, END
```

When the Options menu is chosen, a dotted line appears between the options Receive and Clear Buffer. The second feature defines a special menu title that looks like a rainbow. When you use it, place it in the first menu in your `DATA` statements so it appears at the top left of the menu bar. This menu contains a list of small subroutines, called desk accessories, which perform actions that may be unrelated to the main program. For example, a pop-up calculator or a mini-text editor for making notes would be a useful desk accessory. In order to get the rainbow menu to appear instead of a menu title, put two @ signs in the `DATA` statements, as is done in the following example:

```
100 DATA @@, Calculator, Note Pad,
Get Info, END
```

Adding Windows and Dialog Boxes

CoCo Desktop has some subroutines that let you use windows anywhere on the screen. The first of these starts at Line 12000. This routine draws a window on the screen. It automatically saves what was on the screen, so you don't have to worry about losing anything. Variables `WX` and `WY` tell *CoCo Desktop* where to draw the window. The x coordinate for the top left corner of the window goes in `WX(1)`, and the y coordinate for the top left corner goes in `WY(1)`. The coordinates for the bottom right-hand corner go in variables `WX(2)` and `WY(2)`. After setting these variables, use a `GOSUB 12000` statement to draw the window on the screen. To erase a window and replace the part of the screen it covered, call the subroutine at Line 13000.

A dialog box is similar to a window, but it contains an area in which you can type a response. Usually this kind of window is used to get input from the user. Because there are several different kinds of input (strings, numbers, etc.), *CoCo Desktop* provides a general structure, which can be modified to handle any kind of input. The dialog routine in the program draws a window and an area in which the user can type. It allows a user to enter a string consisting of digits. The part of the program calling this routine converts the string to a number and checks to see if the input is in the desired range. By modifying the

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subroutine to accept characters instead *of digits, dialog* boxes can process string input.

The dialog routine contains some statements that draw a blinking cursor in the area where the user types. There is a provision for checking if the user clicked on buttons marked "OK" and "Cancel." Often people choose a menu option that pops up a dialog box and then decide they did not want to change anything. A Cancel button lets this person abort without any ill effects. The OK button is an alternative to pressing ENTER when finished typing. It can also be used to accept a default value displayed in the dialog box.

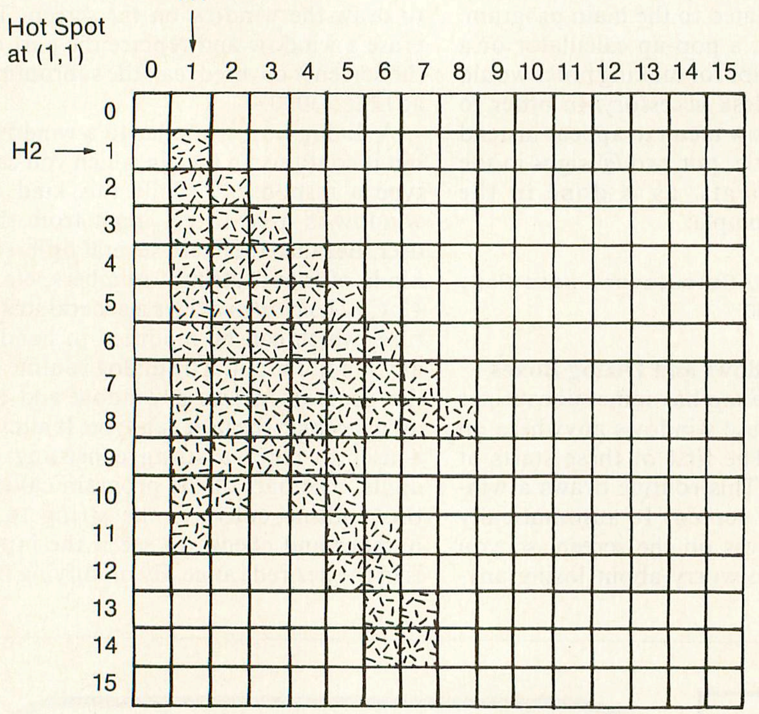

Figure 1

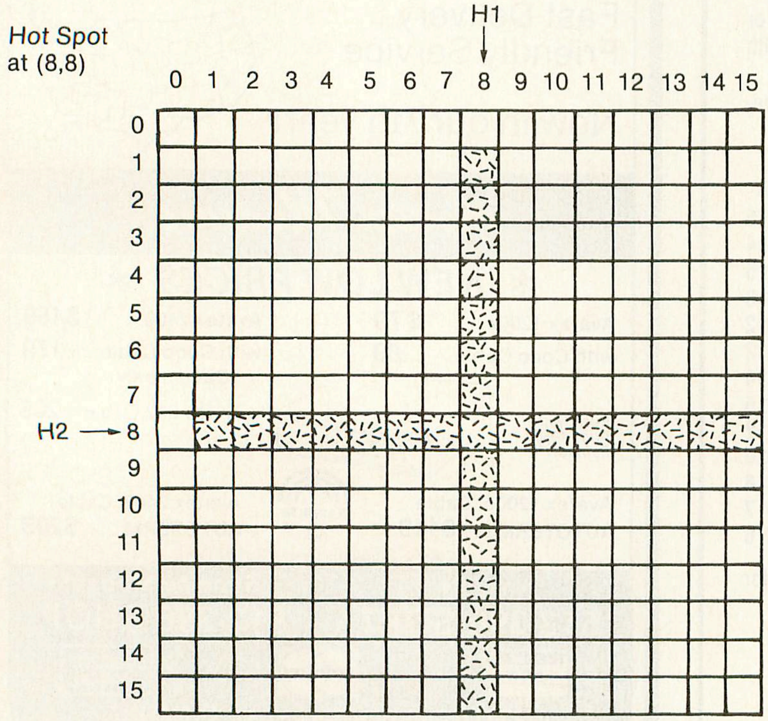

Figure 2

To create a dialog box, draw a window where you want the box to appear. Then you draw the box where the user will type. Do this with the `HLINE` command with the `,B` option. Once everything has been drawn in the window, set variables `P`, `PY` and `L`. `P` is the horizontal screen coordinate where the user will type; `PY` is the vertical coordinate; and `L` is the maximum length of the string the user can enter. Note: `P` and `PY` must be between 0 and 79 because they are used in an `HPRINT` command. Study lines 1000 through 1240 to see an example of the use of the dialog routines.

Moving Around

The workhorse of *CoCo Desktop* is a routine at Line 10000, which checks the mouse and draws the arrow-shaped cursor on the screen. This routine works like BASIC's `INKEY$` command. The difference is that instead of getting a keypress, the subroutine at Line 10000 gets a mouse event. A mouse event is a signal that the mouse was moved or the user clicked. If the user moved the mouse, the routine moves the cursor to its new position and returns. If the button was pressed, the routine responds by setting variables `CX` and `CY`. `CX` and `CY` are used to return to the place on the screen where the button was pressed. For example, if the user clicked at screen position (300,45), `CX` is 300 and `CY` is 45. If the user moved the mouse but did not click, `CX` and `CY` both have the value negative one (-1).

When you click in the menu bar at the top of the screen, a menu pops up, and you can select one of the choices. If you select any of the options, a variable called `SELECT` is assigned a number based on the order of the choices. For instance, if you choose the first option of the first menu, `SELECT` will be assigned the number one. If you choose the second option, `SELECT` will be two. If the first menu contains four options, and you choose the first option in the second menu, `SELECT` will have the value five. The numbers are assigned in the order in which they appear in the `DATA` statements. If there is a dotted line in the menu, it does not count as a choice. If the user does not select anything, `SELECT` will be zero.

When you call Line 10000 in your program and want to respond to the choice made, use an `ON SELECT GOTO` or `ON SELECT GOSUB` statement. If `SELECT` is zero, none of the line numbers in the `ON`

`GOTO` statement will be executed, and the program will drop through to the next statement.

Other Features

In some applications, you will need to clear the screen. So you don't have to worry about redrawing the menu titles, Line 14000 contains a routine that clears the screen and redraws the menu bar. Using this routine instead of the `CLS` command will keep you from having to worry about maintaining the menus.

Once you have created a window, use it for any purpose. Nothing drawn in a window affects any object outside or under the window. When you close the window, everything in the window will be erased, and the screen will appear as it did before the window was opened. However, if you draw outside the window, those changes remain intact even when you close the window. If part of an object is not in the window when the window is closed, only the part of the object in the window will be erased. This also applies to text drawn with the `HPRINT` command.

Problems can arise when you draw objects on the screen. When a window is opened over the cursor or a shape is drawn on top of the cursor, part of the object or window will be erased when the cursor is moved. This happens because of the way the cursor is displayed. Whenever the cursor is drawn, it saves part of the screen. If you draw on the screen without erasing the cursor, the cursor replaces the portion of the screen it saved, wiping out whatever you just drew. Therefore, erase the cursor before you draw anything, and replace it when you are done. This will prevent the cursor from destroying any of your work. A subroutine at Line 15000 will clear the cursor and replace the area it covered. The routine at Line 16000 redraws the cursor. Using these routines guarantees the screen is redrawn correctly.

The subroutines that draw the cursor use Variable `CURSOR$`. This variable contains a string used by the `DRAW` statement to draw the cursor. By creating different strings and assigning them to `CURSOR$`, you can have several different cursors. A cursor must not be larger than 16-by-16 pixels, and you must define the cursor's *hot spot* (the point of the cursor aligned with the mouse). For example, the hot spot for the arrow cursor is (1,1) near the upper-left corner. If you define a cursor shaped like a cross-hair, the hot spot would probably be (8,8), close to the center of the grid (see Figures 1 and 2). Store the horizontal component of the hot spot in Variable `H1` and the vertical component in `H2`. When creating your own cursors, define the `DRAW` string so it will start at the hot spot. If you switch between several cursors in the same program, erase the old cursor with the routine at Line 15000 before calling Line 16000 to draw the new cursor.

Special Notes

You need to be careful about using some aspects of *CoCo Desktop*. The program uses the high-speed poke, so if your program does disk I/O, make sure you slow down the CoCo with `POKE 65496,0` before each disk access. You can speed it up again with `POKE 65497,0` when you are done.

When windows are drawn or menus are popped up, the area of the screen covered is saved in an `HGET` buffer. Because of this, it is possible to crash the program if menu options are too long or you try to create too-large windows.

If the windows get too large, the buffer will not be big enough to save the

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entire area, causing an ?FC (Function *Call) Error.* One possible solution to this is to reserve larger buffers with the `HBUFF` command. The commands that allocate the buffers are in Line 50. Buffer 1 is used to store the area under the cursor. Buffers 2, 3 and 4 are used for menus, and Buffer 5 keeps the part of the screen under the windows. The values for these buffers allow moderately large windows and menus. If you use small menus, you may be able to decrease the buffer for menus and increase the buffer for windows.

If you use long menus, you may need to increase the `DIM` statements in Line *150.* Variable `MENU$` holds the menu titles. It currently holds 10 menu titles. If you need more than 10, increase the dimension of the array. `CHOICE$` keeps the names of the menu options. `NU` stores the number of the menu, which is returned in `SELECT`. `NU` should have the same dimensions as `CHOICE$`. `HEIGHT` must be dimensioned to the maximum number of menu choices, and `WI` and `RANGE` must have the same dimension as `MENU$`.

I chose `HSCREEN 3` as the graphics mode because it provides high resolution without using a lot of memory. *CoCo Desktop* can be modified to use other graphics modes with more colors. If you make this modification, be careful: The other graphics modes use more memory to provide the extra colors, so you will not have as much memory for windows and menus. If you are using medium-sized windows, this should not be a problem. However, big windows might need more memory, so make sure your windows don't get too big.

If you are using `DATA` statements in your program, be careful that your data values do not conflict with the values containing the menu options. As long as your `DATA` statements come after the `DATA` statements containing the menu choices, there should be no problems. There is only one exception: When you use a `RESTORE` statement to reread your data, the statement will restore not only your data but also data for the menu items. You will have to use some dummy `READ` statements to skip the menu choices, so you can read your own data.

Using Variables

In order to minimize conflict between your variables and the variables used by the program, the variables *CoCo Desktop* uses all start with the letters *CD* or the letter *C*, followed by a digit. As long as your program does not use any variables with these names, everything should work fine. However, there are some variables the program uses to communicate with your program that you must avoid as well. These are `SELECT`, `CX`, `CY`, `WX`, `WY`, `CURSOR$`, `RAINBOW$`, `ARROW$`, `MENU$`, `CHOICE$`, `NU`, `HEIGHT`, `WI` and `RANGE`. (See Table 1 for an explanation of the variables.) When selecting variable names, remember that only the first two letters of a variable are significant in BASIC.

`C1, C2, C3, C4`	Loop Variables
`C5`	Unused
`C6`	Unused
`C7`	Current x-position of cursor
`C8`	Current y-position of cursor
`C9`	Previous x-position of cursor
`C0`	Previous y-position of cursor
`CD(0)`	Counts the number of menu items
`CD(1)`	Checks if the routine has been entered
`CD(2)`	Unused
`CD(3)`	Unused
`CD(4)`	Loop Variable
`CD(5)`	Length of the menu option
`CD(6)`	Left margin of menu
`CD(7)`	Number of menus
`CD(8)`	Vertical position of dotted line
`CD(9)`	Unused
`CD(10)`	Unused
`CD(11)`	Scaling factor for menus
`CD(12)`	Unused
`CD(13)`	Right margin of menu
`CD(14)`	The menu that was chosen
`CD(15)`	Scaling factor for menus
`CD(16)`	Scaling factor for menus
`CD(17)`	Scaling factor for menus
`CD(18)`	Top margin of menu
`CD(19)`	Number of characters in the menu bar
`CD(20)`	Loop Variable
`CD(21)`	Loop Variable
`CD(22)`	Bottom margin of menu

Table 1: Program Variables

Conclusion

The listing includes all the *Desktop* routines and a demonstration program using these routines to create a point-and-click Tic-tac-toe game. The game is for two players and does not recognize wins and losses because the demo program was designed to demonstrate the use of windows and pull-down menus. By studying the program, you will be able to get an idea of how the routines work and how to better use them in your own programs. Experiment with the program and feel free to modify it to suit your particular needs.

The routines in *CoCo Desktop* should let you use menus and windows in your programs with a minimum of problems. There are many ways the program can provide a friendly user interface. These range from painting and drawing programs, to point-and-click spreadsheets, to mouse-driven word processors. If you have a collection of short programs, you can draw icons for each one and have them execute when the user clicks on the icon. This provides a nice alternative to the traditional text menus. Alternate high-resolution fonts for the `HPRINT` command can add individuality and style to your program. The possibilities are limited only by your imagination. Be creative and have fun.

(Questions or comments about the program may be directed to the author at 5500 Wabash Avenue, Box 568, Terre Haute, IN 47803. Please enclose an SASE when requesting a reply.) □

170	189	1210	124
340	97	10120	123
550	56	10240	86
690	119	10390	197
840	1	10490	125
1000	5	12080	221
1080	253	END	134

The Listing: DESKTOP

```
0 ' COPYRIGHT 1989  FALSOFT,INC
10 POKE&HF015,&H21 'MAKE SOLID H
PRINT CHARACTERS
20 POKE65497,0
30 PALETTE 0,63:PALETTE1,0
40 PCLEAR1
50 HBUFF 1,512:HBUFF 2,2256:HBUF
F3,512:HBUFF4,512:HBUFF5,4096
60 HCOLOR1
70 HSCREEN3
80 POKE&HFF9A,63 'SET BORDER TO
WHITE
90 CLEAR 2096
100 DATA @@,About The Desktop,Ge
t Info,Key Caps,Music,END
110 DATA File,New Game,-,Quit,EN
D
120 DATA Edit,Undo,-,Cut,Copy,Pa
ste,END
130 DATA Options,Foreground,Back
ground,END
140 DATA END
150 DIM CD(22),MENU$(10),CHOICE$
(10,20),NU(10,20),HEIGHT(20),WI(
10),RANGE(10)
160 ARROW$="C0D13M+3,-3M+1,+1DM+
1,+1D2R3U2M-1,-1U2M-1,+1U2R4M-9,
-9DC1D10M+1,-1U8M+1,+1D6RDRD2RD2
RULU2LU2LU5M+1,+1D3RU2M+1,+1DR"
170 RAINBOW$="D3R1U3M+1,-1URDUM+
1,-1R3M+1,-1R7M+1,+1R3M+1,+1DRUD
M+1,+1RD3LU3D3BL3U2LD2U2M-1,-1LU
RLM-1,-1L7M-1,+1LDRLM-1,+1LD2RU2
D2BR3U2RD2U2M+1,-1R3M+1,+1D2RU2"
180 CURSOR$=ARROW$:H1=1:H2=1
190 CD(1)=1
200 CD(18)=16
210 CD(7)=1:CD(0)=1
220 READ MENU$(CD(7))
230 IF MENU$(CD(7))="END" GOTO 3
50
240 HEIGHT(CD(7))=1
250 WI(CD(7))=0
260 READ CHOICE$(CD(7),HEIGHT(CD
(7)))
270 CD(5)=LEN(CHOICE$(CD(7),HEIG
HT(CD(7))))
280 IF CHOICE$(CD(7),HEIGHT(CD(7
)))="END" GOTO 330
290 IF CD(5)>WI(CD(7)) THEN WI(C
D(7))=CD(5)
300 IF CHOICE$(CD(7),HEIGHT(CD(7
)))<>"-" THEN NU(CD(7),HEIGHT(CD
(7)))=CD(0):CD(0)=CD(0)+1
310 HEIGHT(CD(7))=HEIGHT(CD(7))+
1
320 GOTO 260
330 CD(7)=CD(7)+1
340 GOTO 220
350 CD(7)=CD(7)-1:RANGE(0)=8
360 FOR C1=1 TO CD(7)
370 HEIGHT(C1)=HEIGHT(C1)-1
380 CD(19)=CD(19)+LEN(MENU$(C1))
+2
390 RANGE(C1)=RANGE(C1-1)+(LEN(M
ENU$(C1))+2)*8
400 NEXT
410 RANGE(C1)=640
420 IF CD(19)>80 THEN PRINT"Menu
bar Options Too Long":END
430 FOR C1=1 TO CD(7)
440 FOR C2=1 TO HEIGHT(C1)
450 IF CHOICE$(C1,C2)<>"-" THEN
CHOICE$(C1,C2)=" "+CHOICE$(C1,C2
)+STRING$((WI(C1)-LEN(CHOICE$(C1
,C2)))+1,32)
460 NEXT C2
470 NEXT C1
480 GOSUB 17000 'DRAW MENUBAR
490 ''' END MENU STEUP
500 ''' YOUR PROGRAM STARTS HERE
510 DIM GR(2,2)
520 TURN$="X":FOR T=0 TO 2:FOR T
2=0 TO 2:GR(T,T2)=0:NEXT T2,T
530 HLINE(200,75)-(440,75),PSET:
HLINE(200,115)-(440,115),PSET
540 HLINE(280,35)-(280,155),PSET
:HLINE(360,35)-(360,155),PSET
550 GOSUB 10000
560 ON SELECT GOTO 930,700,790,7
70,900,990,910,660,660,660,1000,
1000
570 IF CX<200 OR CX>440 OR CY<35
 OR CY>155 GOTO 550
580 IF CX=280 OR CX=360 OR CY=75
 OR CY=115 GOTO 550
590 XI=INT((CX-200)/80):YI=INT((
CY-35)/40)
```

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```
600 IF GR(XI,YI) THEN SOUND 55,1
:GOTO 550 ELSE GR(XI,YI)=1
610 A=XI*80+200:B=YI*40+35:MOVE=
1:LX=XI:LY=YI
620 GOSUB 15000
630 IF TURN$="X" THEN HLINE(A+10
,B+5)-(A+70,B+35),PSET:HLINE(A+1
0,B+35)-(A+70,B+5),PSET:TURN$="O
" ELSE HCIRCLE(A+40,B+20),30:TUR
N$="X"
640 GOSUB 16000
650 GOTO 550
660 WX(1)=208:WY(1)=70:WX(2)=430
:WY(2)=120:GOSUB 12000
670 GOSUB 15000:SOUND 55,1:HPRIN
T(29,11),"Sorry, not implemented
":HPRINT(31,12),"Click to contin
ue":GOSUB 16000
680 GOSUB 10000:IF CX=-1 AND CY=
-1 AND SELECT=0 GOTO 680
690 GOSUB 13000:GOTO 560
700 WX(1)=170:WY(1)=70:WX(2)=470
:WY(2)=130:GOSUB 12000:GOSUB 150
00
710 HPRINT(23,10),"The CoCo Desk
top - A programming"
720 HPRINT(23,11),"environment w
hich supports Pop-Up"
730 HPRINT(23,12),"Windows and P
ull-Down Menus.":HPRINT(23,14),"
Available Memory :":HPRINT(42,14
),MEM:HPRINT(49,14),"Bytes"
740 GOSUB 16000
750 GOSUB 10000:IF CX=-1 AND CY=
-1 AND SELECT=0 GOTO 750
760 GOSUB 13000:GOTO 560
770 POKE65496,0:PLAY"T3L2FL8GB-A
GL4O4CCL8CDO3AB-L4GGL8GB-AGFO4CO
3GAL4F":POKE65497,0
780 GOTO 550
790 WX(1)=70:WY(1)=60:WX(2)=310:
WY(2)=112:GOSUB 12000:GOSUB 1500
0
800 FOR C=65 TO 90:HPRINT(11+C-6
5,9),CHR$(C):NEXT
810 FOR C=97 TO 122:HPRINT(11+C-
97,10),CHR$(C):NEXT
820 FOR C=33 TO 58:HPRINT(11+C-3
3,11),CHR$(C):NEXT
830 FOR C=59 TO 64:HPRINT(11+C-5
9,12),CHR$(C):NEXT
840 FOR C=91 TO 96:HPRINT(17+C-9
1,12),CHR$(C):NEXT
850 FOR C=123 TO 126:HPRINT(23+C
-123,12),CHR$(C):NEXT
860 GOSUB 16000
870 GOSUB 10000:IF CX=-1 AND CY=
-1 AND SELECT=0 GOTO 870
880 GOSUB 13000:GOTO 560
890 GOTO 550
900 GOSUB 14000:GOTO 520 'CLEAR
SCREEN AND REDRAW MENUBAR
910 IF MOVE=1 THEN GR(LX,LY)=0:M
OVE=0:IF TURN$="O" THEN TURN$="X
":HLINE(A+10,B+5)-(A+70,B+35),PR
ESET:HLINE(A+10,B+35)-(A+70,B+5)
,PRESET ELSE TURN$="O":HCIRCLE(A
+40,B+20),30,0
920 GOTO 550
930 WX(1)=228:WY(1)=30:WX(2)=410
:WY(2)=90:GOSUB 12000
940 GOSUB 15000 'CLEAR CURSOR
950 HPRINT(32,5),"The CoCo Deskt
op":HPRINT(33,7),"By Tony Zamora
":HPRINT(33,9),"Copyright 1988"
960 GOSUB 16000 'DRAW CURSOR
970 GOSUB 10000:IF CX=-1 AND CY=
-1 AND SELECT=0 GOTO 970
980 GOSUB 13000:GOTO 560
990 POKE 65496,0:CLS:RGB:END
1000 TEMP=SELECT:WX(1)=144:WY(1)
=16:WX(2)=496:WY(2)=64:GOSUB 120
00:GOSUB 15000
1010 IF TEMP=11 THEN HPRINT(20,3
),"Enter the new foreground colo
r." ELSE HPRINT(20,3),"Enter the
 new background color."
1020 HPRINT(53,3),"Cancel":HPRIN
T(55,5),"OK"
1030 HCIRCLE(421,25),8,,1,.5,.75
:HLINE(421,21)-(471,21),PSET:HLI
NE(421,34)-(471,34),PSET:HCIRCLE
(421,30),8,,1,.25,.5:HCIRCLE(471
,25),8,,1,.75,0:HCIRCLE(471,30),
8,,1,0,.25:HLINE(413,26)-(413,29
),PSET:HLINE(479,26)-(479,29),PS
ET
1040 HCIRCLE(421,41),8,,1,.5,.75
:HLINE(421,37)-(471,37),PSET:HLI
NE(421,50)-(471,50),PSET:HCIRCLE
(421,46),8,,1,.25,.5:HCIRCLE(471
,41),8,,1,.75,0:HCIRCLE(471,46),
8,,1,0,.25:HLINE(413,42)-(413,45
),PSET:HLINE(479,42)-(479,45),PS
ET
1050 HLINE(157,37)-(352,50),PSET
,B:GOSUB 16000
1060 P=20:PY=5:L=23:GOSUB 1110 '
INPUT THE COLOR
1070 IF ST$<>STRING$(L," ") THEN
 ST=VAL(ST$) ELSE 1100
1080 IF ST>63 THEN SOUND 55,1:GO
TO 1060
1090 IF TEMP=11 THEN PALETTE 1,S
T ELSE PALETTE 0,ST:POKE&HFF9A,S
T
1100 GOSUB 13000:IF SELECT=0 THE
N GOTO 550 ELSE GOTO 560
1110 R=P:ST$=STRING$(L," "):GOSU
B15000:HPRINT(R,PY),ST$:GOSUB160
00
1120 GOSUB 10000:K$=INKEY$:TR=TI
```

```
MER:IF TR-INT(TR/3)*3=0 THEN HLI
NE(R*8,PY*8-1)-(R*8+1,PY*8+8),PS
ET,B
1130 IF SELECT<>0 THEN ST$=STRIN
G$(L," "):RETURN
1140 'CHECK TO SEE IF THEY CHOSE
"CANCEL" OR "OK"
1150 IF CX>=421 AND CX<=471 AND
CY>=21 AND CY<=30 THEN ST$=STRIN
G$(L," "):RETURN
1160 IF CX>=421 AND CX<=471 AND
CY>=37 AND CY<=46 THEN RETURN
1170 HLINE(R*8,PY*8-1)-(R*8+1,PY
*8+8),PRESET,B
1180 IF K$="" GOTO 1120
1190 IF K$<>CHR$(8) GOTO 1220
1200 R=R-1:IF R<P THEN R=P
1210 MID$(ST$,R-P+1,1)=" ":GOSUB
15000:HPRINT(R,PY)," ":GOSUB1600
0:GOTO 1120
1220 IF K$=CHR$(13) THEN RETURN
1230 IF K$>="0" AND K$<="9" THEN
 IF R<L+P THEN MID$(ST$,R-P+1,1)
=K$:GOSUB15000:HPRINT(R,PY),K$:G
OSUB16000:R=R+1:IF R>L+P THEN R=
L+P
1240 GOTO 1120
9999 'GET A MOUSE EVENT
10000 SELECT=0
10010 C7=INT(JOYSTK(0)*9.9+H1):C
8=INT(JOYSTK(1)*2.783+H2)
10020 IF BUTTON(0)<>0 AND C8<10
AND CD(1)<>1 THEN HPUT(C9-H1,C0-
H2)-(C9-H1+16,C0-H2+16),1:GOSUB
10120:CX=-1:CY=-1:RETURN
10030 IF C7=C9 AND C8=C0 GOTO 10
100
10040 IF CD(1)<>1 THEN HPUT(C9-H
1,C0-H2)-(C9-H1+16,C0-H2+16),1
10050 IF C7-H1<0 THEN C7=H1
10060 IF C8-H2<0 THEN C8=H2
10070 HGET(C7-H1,C8-H2)-(C7-H1+1
6,C8-H2+16),1
10080 HDRAW "BM"+STR$(C7)+","+ST
R$(C8)+CURSOR$
10090 C9=C7:C0=C8:CD(1)=0
10100 IF BUTTON(0)<>0 AND C8>=10
 THEN CX=C7:CY=C8:RETURN
10110 CX=-1:CY=-1:RETURN
10120 CD(14)=1:SELECT=0:C7=INT(J
OYSTK(0)*9.9+H1)
10130 IF C7>RANGE(CD(14)) THEN C
D(14)=CD(14)+1:GOTO 10130
10140 IF CD(14)>CD(7) GOTO 10530
10150 CD(6)=RANGE(CD(14)-1):CD(1
3)=(WI(CD(14))+2)*8+CD(6)-1:CD(2
2)=HEIGHT(CD(14))*8+15
10160 HGET(CD(6)-1,11)-(CD(13)+1
,CD(22)+1),2
10170 HLINE(CD(6)-1,10)-(CD(13)+
1,CD(22)+1),PSET,B:HGET(CD(6),0)
-(RANGE(CD(14))-1,9),3:HPUT(CD(6
),0)-(RANGE(CD(14))-1,9),3,PRESE
T
10180 HLINE(CD(6)-1,0)-(CD(6)-1,
9),PSET
10190 HCOLOR0:HLINE(CD(6),11)-(C
D(13),15),PSET,BF:HCOLOR1
10200 HLINE(CD(13)+2,12)-(CD(13)
+2,CD(22)+1),PSET
10210 CD(4)=CD(6)/8
10220 FOR C3=1 TO HEIGHT(CD(14))
10230 IF CHOICE$(CD(14),C3)="-"
THEN HPRINT(CD(4),C3+1),STRING$(
WI(CD(14))+2," "):CD(8)=(C3+1)*8
+3:FOR C4=CD(6) TO CD(13) STEP 2
:HSET(C4,CD(8)):NEXT:GOTO10250
10240 HPRINT(CD(4),C3+1),CHOICE$
(CD(14),C3)
10250 NEXT
10260 GOTO 10430
10270 IF BUTTON(0)=0 GOTO 10480
10280 C7=INT(JOYSTK(0)*9.9+H1):C
8=INT(JOYSTK(1)*2.783+H2)
10290 IF C7=C9 AND C8=C0 GOTO 10
270
10300 IF C8<9 AND (C7<RANGE(CD(1
4)-1) OR C7>RANGE(CD(14))) AND C
```

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```
7>8 GOTO 10480
10310 CD(15)=FIX((C8-8)/8)
10320 CD(17)=FIX((C0-8)/8)
10330 CD(16)=CD(15)*8+8
10340 CD(11)=CD(17)*8+8
10350 HPUT(C9-H1,C0-H2)-(C9-H1+1
6,C0-H2+16),1
10360 IF C7<CD(6) OR C7>CD(13) O
R C8<CD(18) OR C8>CD(22) GOTO 10
420 'IF C7 IS OUTSIDE, GOTO
10370 IF C9<CD(6) OR C9>CD(13) O
R C0<CD(18) OR C0>CD(22) THEN IF
 CHOICE$(CD(14),CD(15))<>"-" THE
N HGET(CD(6),CD(16))-(CD(13),CD(
16)+7),4:HPUT(CD(6),CD(16))-(CD(
13),CD(16)+7),4,PRESET:GOTO 1043
0 ELSE GOTO 10430
10380 IF CD(16)=CD(11) GOTO 1043
0
10390 IF CHOICE$(CD(14),CD(15))=
"-" THEN HGET(CD(6),CD(11))-(CD(
13),CD(11)+7),4:HPUT(CD(6),CD(11
))-(CD(13),CD(11)+7),4,PRESET:GO
TO 10430
10400 IF CHOICE$(CD(14),CD(17))=
"-" THEN HGET(CD(6),CD(16))-(CD(
13),CD(16)+7),4:HPUT(CD(6),CD(16
))-(CD(13),CD(16)+7),4,PRESET:GO
TO 10430
10410 HGET(CD(6),CD(11))-(CD(13)
,CD(11)+7),4:HPUT(CD(6),CD(11))-
(CD(13),CD(11)+7),4,PRESET:HGET(
CD(6),CD(16))-(CD(13),CD(16)+7),
4:HPUT(CD(6),CD(16))-(CD(13),CD(
16)+7),4,PRESET:GOTO 10430
10420 IF C9>=CD(6) AND C9<=CD(13
) AND C0>=CD(18) AND C0<=CD(22)
THEN IF CHOICE$(CD(14),CD(17))<>
"-" THEN HGET(CD(6),CD(11))-(CD(
13),CD(11)+7),4:HPUT(CD(6),CD(11
))-(CD(13),CD(11)+7),4,PRESET
10430 IF C7-H1<0 THEN C7=H1
10440 IF C8-H2<0 THEN C8=H2
10450 HGET(C7-H1,C8-H2)-(C7-H1+1
6,C8-H2+16),1
10460 HDRAW "BM"+STR$(C7)+","+ST
R$(C8)+CURSOR$
10470 C9=C7:C0=C8:GOTO 10270
10480 HPUT(C9-H1,C0-H2)-(C9-H1+1
6,C0-H2+16),1
10490 HPUT(CD(6)-1,11)-(CD(13)+1
,CD(22)+1),2:HGET(CD(6),0)-(RANG
E(CD(14))-1,9),3:HPUT(CD(6),0)-(
RANGE(CD(14))-1,9),3,PRESET
10500 HLINE(CD(6)-1,0)-(CD(6)-1,
9),PRESET
10510 IF C7-H1<0 THEN C7=H1
10520 IF C8-H2<0 THEN C8=H2
```

```
10530 HGET(C7-H1,C8-H2)-(C7-H1+1
6,C8-H2+16),1
10540 HDRAW "BM"+STR$(C7)+","+ST
R$(C8)+CURSOR$
10550 C9=C7:C0=C8
10560 C7=INT(JOYSTK(0)*9.9+H1):C
8=INT(JOYSTK(1)*2.783+H2)
10570 IF C7>=CD(6) AND C7<=CD(13
) AND C8>=CD(18) AND C8<=CD(22)
THEN SELECT=NU(CD(14),CD(15))
10580 RETURN
11999 'POP UP A WINDOW
12000 GOSUB 15000
12010 HGET(WX(1),WY(1))-(WX(2),W
Y(2)),5
12020 HLINE(WX(1),WY(1))-(WX(2),
WY(2)),PSET,B
12030 HCOLOR0
12040 HLINE(WX(1)+1,WY(1)+1)-(WX
(2)-1,WY(2)-1),PSET,BF
12050 HCOLOR1
12060 HLINE(WX(1)+4,WY(1)+2)-(WX
(2)-4,WY(2)-2),PSET,B
12070 HLINE(WX(1)+5,WY(1)+2)-(WX
(1)+5,WY(2)-2),PSET
12080 HLINE(WX(2)-5,WY(1)+2)-(WX
(2)-5,WY(2)-2),PSET
12090 GOSUB 16000
12100 RETURN
12999 'ERASE THE CURRENT WINDOW
13000 GOSUB15000:HPUT(WX(1),WY(1
))-(WX(2),WY(2)),5:GOSUB16000:RE
TURN
13999 'CLEAR THE SCREEN AND REDR
AW THE MENUBAR
14000 HCLS:GOSUB17000:CD(1)=1:C9
=-1:C0=-1:RETURN
14999 'ERASE THE CURSOR
15000 HPUT(C9-H1,C0-H2)-(C9-H1+1
6,C0-H2+16),1:RETURN
15999 'REDRAW THE CURSOR
16000 HGET(C9-H1,C0-H2)-(C9-H1+1
6,C0-H2+16),1
16010 HDRAW"BM"+STR$(C9)+","+STR
$(C0)+CURSOR$
16020 RETURN
16999 'DRAW MENUBAR
17000 HLINE(0,10)-(639,10),PSET
17010 IF MENU$(1)="@@" THEN HDRA
W"BM12,4"+RAINBOW$ ELSE HPRINT(2
,0),MENU$(1)
17020 C2=2:C1=2
17030 C1=C1+LEN(MENU$(C2-1))+2
17040 IF C2>CD(7) THEN RETURN
17050 HPRINT(C1,0),MENU$(C2)
17060 C2=C2+1
17070 GOTO 17030
```

XTEAM & OS-9

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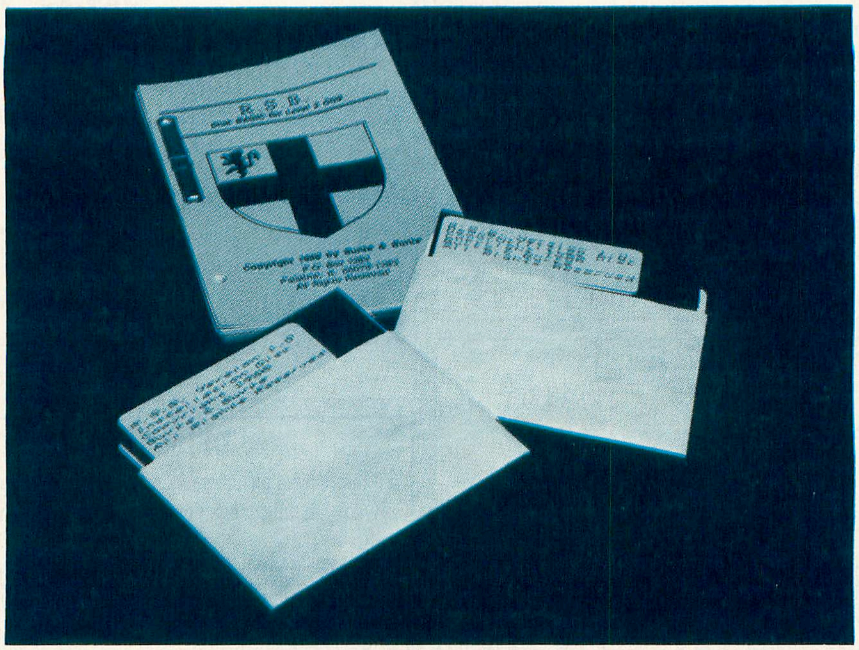


Software CoCo 3 OS-9 Level II

R.S.B.— Real BASIC Under OS-9

You've had your Color Computer 3 for some time now and keep hearing about OS-9. You know that you'll have to try it sooner or later, but you'd rather not just yet —OS-9 sounds so unfriendly. If you could just run all of the programs you've written in BASIC it would make the experience a *lot* easier. But don't you have to learn BASIC09 to write under OS-9? Not anymore, thanks to Burke & Burke.

Now you can run the programs you've written under Disk BASIC and write new ones that take full advantage of OS-9 without having to learn a new language. How is this possible? Burke & Burke have made it easy with the introduction of *R.S.B.*

R.S.B. is an implementation of Disk BASIC under OS-9. To run, it needs a Color Computer 3 (minimum of 128K), a monitor or TV, a disk drive, OS-9 Level II and a floppy controller with one of the following ROMs: Disk Extended Color BASIC 1.0, 1.1, 2.0, 2.1 or Disto CoCo 3 CDOS Disk BASIC. It also supports a printer, multiple floppy drives, hard drives, a mouse and joystick, Speech/Sound Pak or Super Voice, RS-232 Pak, and *Multi-Vue*. It will even work with a cassette recorder. A 512K CoCo is recommended, though, if you really want to take advantage of graphics or run BASIC programs longer than 100 lines.

So how does it work? *R.S.B.* comes with two disks, one labeled Installation Disk and the other Demo/Utilities Disk. After backing up both disks, the user merely inserts the Installation Disk in drive `/d0` and types `install`. Of course, the execution and data directories must have been previously switched to `/d0` with `chd /d0`, `chx /d0`. Also, `Install` must be run from a high-resolution window, not the default VDG screen.

The `Install` program reads the Color Computer's BASIC interpreter from ROM and writes it on the disk. It then modifies certain portions of the program to allow it to run under OS-9. This process uses all of the computer's power and takes about 10 minutes. Once `Install` has been run, *R.S.B.* can be copied into the normal execution directory and run any time.

R.S.B. can be run from the command line in either a VDG or a true window, or it can be executed from the *Multi-Vue* environment by clicking on its icon, which, along with an AIF, is included on the disk. *R.S.B.* can be called with just one parameter,

`-g`, which tells it not to allocate a VDG graphics screen at startup. Because Lo-Res graphics will still run in a Hi-Res window even if `-g` is specified, it is a good idea to use it if you don't run *R.S.B.* from a VDG screen. The `-g` option saves about 6K of RAM. *R.S.B.* can also be called with a program name that it will load and execute automatically.

The documentation is excellent. The first few chapters explain the process of installation and execution. The later chapters and appendices detail the differences between standard Disk BASIC and *R.S.B.* and give instructions on how to use the utilities. The manual also goes into detail about the program's internal operation and memory map.

The program itself starts up with a black-on-green copyright notice followed by the standard Disk BASIC message. Operation from this point on is almost exactly like disk BASIC, except that all commands can be entered in lowercase. This feature is similar to BASIC09, and, as with BASIC09, all keywords entered in lowercase are capitalized, including hexadecimal numbers.

> ***"All of the graphics routines in R.S.B. have been modified to use OS-9's graphics commands."***

The Demo/Utilities Disk contains several short demonstration programs in BASIC. All of these worked fine, with one exception — `Joy.bas`. This program constantly calls `JOYSTK(0)`, `JOYSTK(1)`, `JOYSTK(2)` and `JOYSTK(3)` and prints their values onscreen. Those familiar with Extended BASIC know that `JOYSTK(0)` refers to the horizontal axis of the right joystick and `JOYSTK(1)` refers to its vertical axis. This is also what the *R.S.B.* manual indicates. However, it seems that `JOYSTK(0)` returns the vertical position of the left joystick and `JOYSTK(1)` returns its horizontal value. For review I had available Version 1.1. Version 1.2 is out now, and I've been informed that this version fixes the joystick problem.

I tried to run one of my own programs, in which the user flies a helicopter around the screen with the right joystick. After several minutes of frustration, I figured out that if I used the left joystick and pushed left and right in order to go up and down, and up and down in order to go left and right, everything worked fine — almost. The helicopter was one solid color, the color that its windshield should have been, and the animation was incredibly slow, as was the sound. The differing color is explained by the fact that, as the manual states, the way the coordinates are scaled causes the lines in `DRAW` commands not always to meet as expected. This caused my painting of the windscreen to fill the entire helicopter. Also the `HPAINT` command works differently under *R.S.B.* because it uses OS-9's `Fill` command. The slowness of animation and sound is caused by OS-9's multitasking, and thus the computer is constantly interrupting the BASIC program in order to check for other tasks. Chris Burke has corrected this slight bug, also, and posted a fix on Delphi. It is fixed in Version 1.2.

Two years ago, before I had OS-9, I wrote a program to solve *n* equations of *n* unknowns using Gaussian elimination. When I got OS-9, I never bothered to rewrite the program and always ran it from BASIC. Now, I'm happy to say, I can run it from OS-9 and don't have to keep rebooting. In fact, the only programs that I have had trouble running involve graphics. For instance, I have trouble with a

OS-9 for the Common Man

Last year at the Princeton RAINBOWfest, Burke & Burke celebrated one year of providing excellent products for OS-9 and the CoCo. Their first offerings made hard drives affordable, and now their latest product makes OS-9 usable.

What is this product? *R.S.B.*, Disk Extended BASIC for OS-9. Now users can run their old Disk Extended BASIC programs under OS-9 — and write new ones, using all of OS-9's power in the old, familiar language.

Why bring BASIC to OS-9? Chris Burke, *R.S.B.*'s developer, says that OS-9 is important to the survival of the Color Computer, and that if people are going to get the most out of their CoCos, they are going to have to start using OS-9. However, many people don't like OS-9 or are afraid to try it because they think it is so unfriendly. Besides, they've written a lot of neat programs in Disk BASIC. So Chris produced *R.S.B.* to "bridge the gap" between the familiar environment of Disk BASIC and the hostile environment of OS-9.

As interesting as the products Burke & Burke comes out with is Burke & Burke itself — or themselves — Chris, a hardware/software engineer for a major electronics company, and Trisha, a flight attendant. Shortly after their marriage two years ago, Trisha says, Chris was looking into adding a hard drive setup to his CoCo. The whole system from Radio Shack would cost about $800, and Chris wondered why he couldn't build an interface for PC-compatible hardware to put together a system more cheaply.

He built it, calling it the CoCo XT Interface. This interface allowed him to assemble a comparable hard drive system for between $400 and $600 — almost half of Radio Shack's price. He realized other people were thinking along the same lines when he saw a question in Marty Goodman's "CoCo Consultations" column asking about the possibilities of interfaces and cheaper PC equipment. This realization sparked the teamup of husband and wife in a venture to market the interface: Trisha, with her business background, would take care of management, and Chris would handle the programming/designing end. Burke & Burke's fledgling product was successful, for it scratched an ever-increasing itch among the CoCo Community. The interface is still available for its original price of $69.95 ($99.95 for a version with a clock).

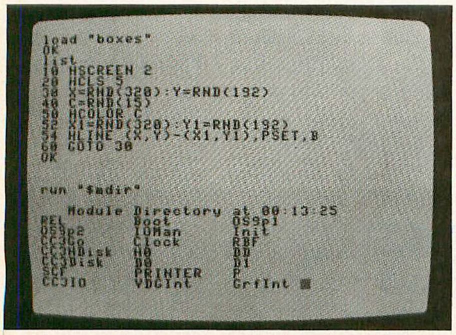
Trisha says the couple works around the clock, getting only five to six hours of sleep at night. "It never ceases to amaze me that he never tires of this," Trisha said of Chris. "He'll spend eight hours at work and come home and work eight hours more. I just cannot keep pace with him." In those midnight vigils Chris and Trisha manage to fill all their orders and plan and develop new products, too. The couple is planning a move from Illinois to Washington state, where they will devote their full time to running Burke & Burke and developing new CoCo products.

What great future products are they currently working on? As far as hardware is concerned, they're designing an IBM bus adapter that will allow CoCo users to plug in expansion cards made for the PC and clones — possibly even graphics cards. In the software area, they are working on a multiuser OS-9 game. They are also considering writing an OS-9 arcade game, and are checking into the possibility of converting one of the current non-OS-9 word processors to OS-9. I think this last project, especially, will fill a real need, and will again make the user's introduction to OS-9 just that much easier. ☐

graphing program I wrote. The problem revolves around a modification I made to the `HSCREEN` routine so that it doesn't clear the graphics screen. This allows me to graph multiple equations on the same screen. This patch did not work under *R.S.B.*, but the manual gave an equivalent patch. So I changed all of my `POKE` *x,y* commands to reflect that change in address of the routines, with the result that the `INKEY$` function stopped working. This problem is caused by the fact that all of the graphics routines in *R.S.B.* have been modified to use OS-9's graphics commands.

R.S.B. does all of its disk I/O in standard OS-9 format. This means that one can't simply insert a Disk BASIC disk and type `LOAD`"*filename*". Programs are ported to OS-9 using the utilities that are included on the Demo/Utilities Disk. These are `SKITZO`, `HDIR`, `HCOPY`, `HDEL` and `WIDTH`. `WIDTH` merely changes the window format from 80 to 40 to 32 columns. The other utilities are for file transfers.

The first utility, `SKITZO`, formats a disk so that the first half is in OS-9 format and the last half is in Disk BASIC format. Once a disk's personality has been split with `SKITZO`, one merely copies programs onto it from Disk BASIC. `SKITZO` is amazingly simple to use — just put a newly formatted disk in a drive and type `skitzo /d0` or `skitzo /d1` (or `/d2` or `/d3`, depending on how many drives you have and which one you put the disk in). When the files to be transferred have been copied onto the disk, and OS-9 has again been booted, you can copy the Disk BASIC files onto the OS-9 half of the disk, or OS-9 files onto the Disk BASIC half with `HCOPY`. `HDIR` is used to get a directory of the Disk BASIC portion of the disk, and `HDEL` is for deleting files from the Disk BASIC half.



```
load "boxes"
OK
list
10 HSCREEN 2
20 HCLS 5
30 X=RND(320):Y=RND(192)
40 C=RND(15)
50 HCOLOR C
52 X1=RND(320):Y1=RND(192)
54 HLINE (X,Y)-(X1,Y1),PSET,B
60 GOTO 30
OK

run "$mdir"

    Module Directory at 00:13:25
REL         Boot        OS9p1
OS9p2       IOMan       Init
CC3Go       Clock       RBF
CC3HDisk    H0          DD
CC3Disk     D0          D1
SCF         PRINTER     P
CC3IO       VDGInt      GrfInt ▪
```

`SKITZO` and `WIDTH` worked perfectly on my system, but I had to reformat my disk with only 35 tracks for the other three to work. So I could either reformat my disk with only 35 tracks, or I could use a nifty utility that can have several options passed to it on the command line. One of these, `-t`, is used to set the number of tracks. When I called utilities with `-t40`, they all worked perfectly. Passing the `-?` parameter to a utility will give a listing of all the options available with that utility.

I think that *R.S.B.* is an excellent package, and I highly recommend it. It will allow beginners to step easily into OS-9, and let experienced users run the old programs they wrote in Disk BASIC. I hope it will draw many new users to OS-9.

(Burke & Burke, P.O. Box 1283, Palatine, IL 60078, 312-397-2898; $39.95)

—Robert Marsa

Software

CoCo 1, 2 & 3

ZoomDump— Versatility at an Attractive Price

Have you ever wanted your dot-matrix printer to print out your CoCo `PMODE 3` and `PMODE 4` graphics screens at specific sizes? Or have you wished your current screen dump software could do more than simply print out an entire `PMODE` graphics screen? If you've been yearning for greater control over the way your `PMODE` graphics are printed on the page, then *ZoomDump* may have the features you've been looking for.

ZoomDump is a machine language program with an easy-to-use BASIC driver. The program comes on disk or tape and prints out `PMODE 3` and `4` graphics while you control the printout size and height-to-width ratio. In addition, the program gives you a choice between printing out the full `PMODE` screen or just a rectangular portion. To run *ZoomDump*, you need any version Extended Color BASIC CoCo, a dot-matrix printer (DMP-105, DMP-106 or compatible) and a disk drive or CoCo-compatible tape recorder. The program is not copy-protected.

I began my evaluation by reading the two pages of documentation that come with the program. On the first page, there are two paragraphs outlining the easiest method for using *ZoomDump* via the BASIC driver, which is a program written in Extended Color BASIC that simplifies entering the printout parameters and running the program. The second page of *ZoomDump*'s documentation contains information covering the use of *ZoomDump* without the BASIC driver. This method lets you pass commands directly to the program's machine language routine using Extended Color BASIC's `USR` function. While not as convenient to use as the BASIC driver, entering commands in this way allows more control over *ZoomDump*'s operations. It would be interesting to those with some knowledge of machine language procedures.

Running the program from the BASIC driver was simple and straightforward. I began my first screen dump by selecting a `PMODE` screen graphic from which to work. I chose an image that was drawn on the `PMODE 4,1` screen (a 256-by-192 pixel, two-color screen on `PMODE` pages 1 through 4). The documentation lists a one-line BASIC command sequence that may be typed in, so you can have a look at what's on the current `PMODE` screen before printing it out. I ran the one-liner, and once I was confident the `PMODE` image I wanted was in memory, I put the *ZoomDump* disk in Drive 0, typed `RUN "Z"` and pressed ENTER. The program installed itself quickly and began with a request for the first of 10 options that would determine just what, where and how the screen would be printed.

M. Hawkins T. Harris T. Earles

The available options include the selection of height and width (in inches) of the printed graphic, the graphic's distance from the left margin, and whether all or only a rectangular portion of the screen should be printed. If you decide to print only a portion of the screen, you can select the size and location of the print area at the resolution of a `PMODE 4` screen (196-by-255 pixels). With this control, it is easy to select even a small section of the screen and "blow" it up to fill a full sheet of paper.

Once I had answered the prompts and pressed ENTER for the last time, my DMP-105 printer sprang to life. My 4-by-5-inch graphic took about 13 minutes to print at 600 baud. The result was a clean, accurate print of the current `PMODE` screen in 4-by-5 inches, centered on the paper. Everything was just as I had specified.

Working from the BASIC driver, I explored other options that offered further control over my printout. There is a "Sideways" option with which you may print the screen graphic on its side so that the bottom of the `PMODE` screen is parallel to the left margin of the paper. While 7.9

inches is the maximum allowable horizontal width, there is no upper limit given on how many pages "long" a print may be. *ZoomDump* had no problem when I gave it a two-page, 7.8-by-18-inch full-screen graphic to print.

The program also had no problem printing sections of screens at the desired proportions and dimensions. It easily printed such extreme proportions as 1-by-7 inches, where images are stretched and squashed to create interesting effects. The best prints came from `PMODE 4` graphics when the foreground was black and the background was white. While `PMODE 3` graphics may also be printed, they come out as they appear on the `PMODE 4` screen — with limited shading values. Blues and yellows and magentas and cyans are indistinguishable on the print.

I was somewhat confused by the behavior of the option that allows switching of the foreground and background colors for a positive or negative print. Selecting negative did not always print a negative of what I saw on the screen, and selecting positive did not always print a positive image of the screen. Due to the different ways in which the video hardware and the printer interpret a bit as output color, an image that "looks negative" on the screen may not necessarily "look negative" on the paper. Usually I kept my eye on the printer to see what was actually printing out so that I could abort the dump if the image was not what I wanted. Because there is no option to stop the program in the middle of a printout, aborting the procedure requires resetting the CoCo 3 by pressing the Reset button.

I was happy to see that the program implemented a one-minute pause every five minutes of continuous printing. This "duty cycle" pause keeps the printer head from becoming too warm and is perfect for the DMP-105. You cannot use the BASIC driver to adjust the duty cycle for other types of printers; however, adjustment is possible by passing variables to *ZoomDump* via Extended Color BASIC's `USR` function.

To run *ZoomDump* using the `USR` function instead of the BASIC driver required a little more work, but the lines of code can be entered as a simple BASIC program and then saved to disk. It is then a simple matter to run the small program as many times as you want with all the printout options already in place. This option kept me from answering all the prompts that come with each run of the BASIC driver.

Overall, *ZoomDump* performed very well for the price, and I can recommend it with enthusiasm to all CoCo users.

(Codis Enterprises, 2301-C Central Drive, Suite 684, Bedford, TX 76021; $14)

—Walter Myers

Software CoCo 3

GAT Backup— Fast Disk Duplication for the CoCo 3

I have to admit, I like hardware. As soon as I bought my Color Computer 3, I was looking for a 512K upgrade. I run two Tandy 1000 double-sided drives with a popular optional operating system. I've had my RGB monitor for years. And I like programs that use my accessories to their maximum. So when I picked up a certain CoCo 3 512K backup program that would work with up to three 40-track, double-sided drives at the Princeton RAINBOWfest, I was in heaven. This program would duplicate disks at "lightning" speed in a single pass. It ran so fast I couldn't keep up with it.

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Let's face it: The typical CoCo 3 disk user has only 128K and usually one drive, which Disk Extended Color BASIC addresses as single-sided, 35-track. Our average user is probably getting a little tired of the archaic `BACKUP` command, which hasn't changed since the CoCo 1 days. It's slow and takes *seven passes* to copy a disk. In addition, you have to physically swap your original and copy disks at each pass. (I can't remember how many times I've gotten confused and tried to back up the target disk to the source.) To say that this procedure is frustrating would be an understatement.

Enter GSW Software's *GAT Backup*. The company claims its product can back up a 35-track disk in two passes, a section of a disk or only the granules used. A *Gatling gun* for the CoCo 3, the program does all that — and more.

GSW's menu-driven operation allows first-time users to go directly to work. After running the simple BASIC loader, `G/BAS`, the screen displays an easy-to-read menu:

1) GAT backup
2) Section backup
3) Entire disk backup
4) Directory
5) Format a disk
6) Set number of copies

If you haven't already run `DSKINI0` on your blank disks, you're in luck. Option 5 instructs you to insert the disk to format and press ENTER. Want to make sure there's nothing important on that disk? Option 4 offers information about the disk, calling up a disk directory.

The formatting function is no ball of fire; it's clearly linked to the `DSKINI` command and is here for your convenience. When you're ready to start the fireworks, press 3 to back up your disk. The program will ask you to enter the source disk and press ENTER. The disk drive then comes to life and the numbers of the tracks and sectors being read into memory flash by on the screen. If there is an error of any kind, the program gives you the option of skipping the affected granule, trying it again, or returning to the main menu to do something else.

After it finishes reading, the computer asks you to replace the source (original) disk with your target (copy). Again the drive spins and the numbers whiz by. The procedure is then repeated to copy the other half of the source to your target. The time and frustration saved on the entire disk backup is worth the $15 price tag alone, but there's more.

With *GAT Backup*, it's possible to copy selected sectors of the disk. Option 2 asks the user to identify the starting track and sector and the ending track and sector. The program then reads the appropriate granules to memory. Although not for the casual user, this function can be very useful for hackers.

While these options are wonderful in themselves, Option 1 is what makes the program shine. It works exactly like Entire Disk Backup, but it ignores blank tracks, copying only the granules actually used. I've never seen anything like it; if you have a regular 67-granule disk (type `FREE(0)` sometime to find out how many granules you have left) with only 20 or 30 granules in use, why copy the whole thing? *GAT Backup* zips through only the parts of the disk you actually used and ignores the rest. Indeed, the program copied the disk it was supplied on so fast I wasn't sure it worked. The three granules were copied in seconds.

The Set Number of Copies option asks you how many copies you want to make. You'd better have a pile of blanks ready to use; it will read your original and then have you put every copy disk in once for each of the two passes.

The company has even included an "oops" key: If you make a mistake or want to cancel an option before it does its work, pressing the ESC and BREAK keys brings the query, "Do you want to abort to the menu?" The program can also be terminated from the menu with the ESC/BREAK combination. The program will ask if you are ready to exit. If you press Y, the program will execute a warm restart.

Like any other disk backup program, *GAT Backup* cannot and should not be used to copy protected software, nor is it

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intended to be used to back up your latest copyrighted games and applications for your friends; but if, like me, you make up a "club disk" for your users group every month, it can be a great time saver.

I can think of one change I'd suggest for this program; I would like the addition of a multiple-drive option because it assumes you just have Drive 0. With two drives, *GAT Backup* would become almost automatic, writing to Drive 1 in record time.

GAT Backup is a well-conceived, finely executed program. It is simple enough for a novice user yet lends flexibility to the seasoned hacker, and it delivers what it promises for a very reasonable price.

(GSW Software, 8345 Glenwood, Overland Park, KS 66212, 913-341-3411; $15; software source, $5: First product review for this company appearing in THE RAINBOW.)

—Fred Toon

Software CoCo 2 & 3

Silpheed— Space-Age Dogfighting

Silpheed is billed by Radio Shack as "The Hit Japanese Arcade Game." Well, after playing it with my 11-year-old daughter, I can see why it's so popular. In *Silpheed* (who comes up with these names?) you are the pilot of a super space-age dogfighter in an intergalactic war to defend the United Universe from an evil empire. If you can survive 16 levels of attack, you get to engage in the ultimate battle for control of the galaxy. Sixteen? We're only up to seven, but we're having a ball trying.

> ***"A lot of programming effort went into creating some neat effects. I like the wobbly movement of my ship when I receive several hits."***

Silpheed is supplied on a ROM pack and can be plugged into either the cartridge slot of your computer or into a vacant slot on your Multi-Pak Interface. The program works on both the CoCo 2 and 3, but the graphics are much sharper and detailed with the CoCo 3. The graphics and sound effects were excellent on my CoCo 3 and CM-8 monitor. Provisions are made to run it on a composite color monitor, as well.

A lot of programming effort went into creating some neat effects. I like the wobbly movement of my ship when I receive several hits. Other handy features include the ability to toggle the sound on or off and to pause the action while you try to collect your wits. The game works OK with the arrow keys, but I recommend a joystick, as the fighter is very responsive to joystick control. The action is very fast and furious. I was impressed with the 3-D-like screen, complete with stars that seem to rush past the spacecraft.

An interesting feature in this game is the ability for players to choose specific armament for their fighter. In addition to the various enemy crafts you will encounter, there are also a number of little square-lettered boxes that you will want to try to collect, although they, too, are quite evasive. Hitting these little blocks results in various features to assist you in battle. Hitting B provides a temporary barrier. The D will destroy all enemies on the present screen. Finding F results in automatic fire. The H key advances your shield, and I provides temporary invincibility. I was constantly seeking the R block, which repaired all my ship's damage. Hitting S will result in a warp-like speed, and W allows you to select your weapons as displayed in an overhead expanded view of your ship. Onscreen scoring is provided, as well as other game data and screens survived.

Silpheed is a fun-packed arcade game.

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—Jerry Semones

Software OS-9 levels I & II

L1+L2 Combination Pak—Utilities for OS-9

Today, most computer owners use their machines for application programs — word processors, spreadsheets, databases, etc. However, as good as these applications may be, they are never able to do all things for all people. Enter the world of the utility! Two software packages from D.P. Johnson, *L1* and *L2* (not to be confused with the OS-9 levels I and II), provide utilities to do just about everything — if you are willing to spend time reading the manual. I can't emphasize this too much.

An examination of tables 1 and 2, which list all of the utilities contained in the *L1* and *L2* packages, will confirm the above statement on the necessity of reading the manuals. It should also be evident that space does not permit a discussion of all these utilities. For this review I have selected several utilities that should be of interest to beginning and intermediate OS-9 users.

Access	used within a macro to determine if a pathname exists.
AFMT	assembly source code formatter.
Append	copies a source file to the end of an existing file.
Bell	sounds the bell.
Buf	reads the standard input until an eof or the buffer is full; then writes to standard output.
Confirm	writes a text message to standard output and waits for a key to be pressed.
CP	copies files from standard working directory to destination pathname.
DisInp	disassembles file listed from standard input to standard output.
DL	reads a list of names from standard input that are assumed to be files in the current directory, and deletes them.
Eat	reads lines of text from standard input and deletes the first n characters from each line.
FF	sends a form feed to the printer.
Filter	copies standard input to standard output, removing all occurrences of a specified character.
FixCRC	updates the CRC value of a memory-resident module.
FList	reads a list of filenames and lists each file to standard output.
Fold	reads lines of characters from standard input and moves n characters at the beginning of the line to the end of the line.
ForceError	causes an error number to be returned to the shell. Useful in macros for flow control.
GRep	reads lines of characters from a file and passes only those lines that meet the specified match criteria to a standard output.
Info	for a given file, displays the owner, creation date, modification date, attributes and byte count.
ListTFDS	lists the 256-byte file descriptor.
LS	lists filenames, one name per line to standard output.
MacGen	command macro generator that allows the building of new commands from existing commands.
Mecho	a multi-line echo command that allows listing what would normally be several lines of input on one command line. Mecho translates the tilde character to a carriage return.
MemList	provides a listing of memory in unformatted binary.
MemLoad	reads standard input into memory beginning at the specified absolute memory address.
ModBuster	breaks a file containing several modules into separate files.
MV	moves a file from one directory to another without physically moving the file, i.e., copying.
NulDevice	contains driver and descriptor to implement a null device or "bit bucket."
Pag	formats standard input as to top, bottom, left and right margins and sends to output.
Rep	provides the capability to make any OS-9 command repetitive.
ResMem	reserves an area of memory for special use.
ReWrite	writes standard input to specified pathnames at a specified offset. Provides ability to overwrite a file.
SectEdit	a menu-driven sector edchanges
Sell	changes ownership of a file.
SetAt	changes attributes of a file while preserving currently set values.
Size	reports size of specified file.
Sort	a filter that sorts filenames.
Split	splits a file into multiple files according to a specified number of lines or bytes.
Touch	changes the modification of filenames specified on standard input.
Unload	repeatedly unlinks memory-resident modules until their memory is freed.

Table 1: *L1* Utility Pak

L1 Utility Pak

Of all the utilities contained in this package, `MacGen` is an important one to start off with because it provides you with the capability to build additional utilities from existing ones.

`MacGen` is a command macro generator that will build new commands out of existing executable program modules. Users with a UNIX background will appreciate `MacGen` because it adds capability that is found in the Bourne shell. Among `MacGen`'s many features are shell variables and control structures such as `FOR/NEXT`, `REPEAT/UNTIL`, `IFNUL/ELSE/ENDIF` and a number of other features. In essence, `MacGen` provides an extension to shell programming that allows the development of fairly complex shell scripts without having the user resort to a major programming effort.

The `LS` command is in many respects the heart of the *L1* Pak. In its simplest form it provides a single-column listing of files in the current directory. It supports the standard wildcard characters (* and ?) as well as a character range (all the files whose names begin with the letters A to G, for example). `LS` can also list files based on ownership, date and attribute. For date, `LS` can select on year, month, day or hour, etc. The output of `LS` is often used in a pipe as a source of data for many of the other utilities.

`CP` copies files from the default working directory to the destination path. This is a multiple-file copying utility; Tandy's is a single-file copying command. Options include the following: the ability to update a file if its modification date is older than the file being copied; straight replacement of an existing file; and the options to ignore filenames not found (great for poor typists who have just typed a long list of filenames).

The combination of the `LS` command with the `CP` command provides tremendous file manipulation capability. For example, the command

```
LS | cp -u /h0/archive
```

copies all of the files in the current directory to the archive directory on the hard disk. Should any of the files already exist in the archive directory, they will be updated. In another example using wildcards, all C source files could be copied to the archive with the following:

```
LS *.c | cp -u /h0/archive
```

As a final example, the following command line will copy all files created with today's modification date:

```
LS -t | cp /h0/archive
```

`MV` is another useful utility. `MV` moves files in the current data directory to the specified directory. Using the `-i` option, `MV` will ignore existing files in the specified directory that have the same name as those being moved. This command comes to be quite useful, especially after you have just copied 20 files to the wrong directory! The following example illustrates the use of `LS` and `Sort` with `MV`:

```
LS | sort |mv /d1/cmds.sorted
```

In this example, `LS` will list all files in the current directory, `Sort` will sort them alphabetically, and `MV` will move the filenames in the sorted order to the `/d1/CMDS.SORTED` directory. It is important to note that `MV` does not physically move the files but merely updates the appropriate directory.

OS9P3	a module that provides the "Print Error" function to Level II, an English translation of the OS-9 error number.
RAMDisk	the modules `C` and `Cache` provide the capability to create a RAM disk for any memory size.
Clone	provides multiple links to the same file so that duplicate copies do not have to be maintained in separate directories.
DPRM	provides a Hex memory dump of a process ID's memory to standard output.
Dump	produces a formatted Hex/ASCII dump of a file to standard output.
DumpMem	dumps memory to standard output.
DumpPR	dumps a process descriptor to standard output.
FLS	reduced version of `LS` from the *L1* package.
GrabMap	dumps system memory block map to standard output.
ImageCopy	duplicates partially full diskettes.
ImageSave	stores partially full diskettes.
MakeRRMod	generates the data module used by the Print Error function.
MSave	copies the list of memory modules to standard output.
OS9Genz	an improved `OS9Gen` command.
Remove	deletes cloned file directory entries.
WhoAmI	prints your user ID number on the terminal.

Table 2: L2 Utility Pak

The `Rep` command is a way of making any OS-9 command repetitive. This is a much-needed feature that, unfortunately, Microware left out of OS-9. The following example best illustrates the use of `Rep`:

```
LS | REP ident $
```

In this example, `Rep` repetitively runs the `Ident` command for each filename passed to it by the `LS` command. The `$` tells `Rep` to read one line from the standard input and insert the text at that point.

`GRep` provides the capability to extract lines of data from a text file according to a specified matching criteria. The wildcards * and ? are supported. In addition,

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Dragon Blade (CoCo I/II/III) See Nov '86 review. Slay evil dragon in this 64k animated adventure! Disk..$19.95

`GRep` can select from either the beginning or the end of a line according to the specified search pattern. `GRep` could actually be used as a very simple database — for keeping lists of phone numbers, for example. This command would find the phone number for Smith in the file `phone.list`:

```
GRep ^Smith phone.list
```

L2 Pak

In addition to the utilities listed in Table 2, the *L2* package contains two modules that can be added to `OS9Boot` — `OS9P3` and a RAM disk. In the original OS-9 Level I system, as delivered by Tandy, there was a "print error" command that caused OS-9 to print an English message whenever an error occurred. This capability was never included in Level II; however, with the `OS9P3` module and the associated print error command, Johnson has restored this capability. But this version allows the user to turn this capability on or off, something the original Level I version did not. Of course, the addition of this capability requires the generation of a new `Boot`, which for many can be a trying experience.

The modules `Cache` and `C` provide the capability for a RAM disk. To set up a RAM disk, these two modules must be added to `OS9Boot`. Once the new boot is made, the RAM disk can be established by simply entering the OS-9 command `Iniz /C`. A very nice feature of this RAM disk is that it is adjustable. Using the provided `CSize` command, you can change the size or the name of the RAM disk before it is `Iniz`'d. Some users may prefer `/R0` or `/M0` instead of the default `/C`, or a different size from the default 96K. Another advantage of Johnson's RAM disk is that it can be removed with the `Amputate` command, returning the memory to the free system memory pool. To my knowledge, this capability is not possible with Tandy's RAM disk that is included in the *Development* package.

The utilities `Clone` and `Remove` are particularly worth noting, especially for users with hard disks. As an example, I currently have three execution directories on my hard disk: `/h0/CMDS`, `/h0/APPL` and `/h0/ETC`. While these directories are useful for organizing all of my programs, there are times when I am in one directory and need something from another. `Clone` makes a new directory entry for a file that's in another directory.

Well, this review has grown quite long, and as I said in the beginning, it is impossible to discuss all the utilities provided in these two software packages. So, look over the two tables for the contents of both packages. Many of you have probably recognized a number of similar utilities available on Delphi or from the OS-9 Users Group. The advantage of buying Johnson's software packages is that they are supported with very good documentation. And they *work*, which is something you can't always say for the public domain counterparts. As many of you know, D.P. Johnson is the author of *SDisk* and has a reputation for excellent software.

One really nice feature of Johnson's software is the way he packages it. The disk is contained in a sealed envelope, while the documentation is "available" to allow the purchaser to read everything about the software. If you decide that the package is not for you, you can return it and obtain a full refund (as long as you don't open the envelope!). To me this is an excellent way of selling software — it protects the author from piracy and gives the purchaser the opportunity to get a good view of the package before deciding to accept it. I wish that all software companies would adopt this approach, as we would all be better off for it.

For those just starting OS-9, as well as for the more advanced user, I strongly recommend buying *L1* and *L2*. This is good software, with very good documentation, and is a must for any serious OS-9 user.

(D.P. Johnson, 7655 Cedarcrest St., Portland, OR 97223, 503-244-8152; $49.95 for *L1 Utility Pak*, $39.95 for *L2 Utility Pak*, $75 for *L1+L2 Utility Pak*)

—Donald Dollberg

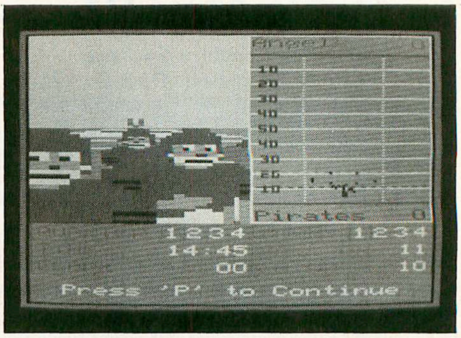
Software

CoCo 3

Football II— Running in the End Zone

Football II is a one-player football simulation for the CoCo 3. Unlike most other football games that give you just a blimp's view — that of looking down on the field — *Football II* gives two views. The left half of the screen is at ground level, letting you see the game from a player's viewpoint. The right half of the screen is from high in the end zone.

The first thing to do is draft the teams. You can either choose your opponent's team or let the computer pick its own. You then decide which team you want to coach; every team has its strengths and weaknesses. There are 20 different teams to pick from. Next you get to decide whether you want a game with 15-minute quarters or short 7 1/2-minute quarters. (If you choose the 15-minute quarters, you are allotted 30 seconds to make a play selection. If you choose the shorter quarters, you have 15 seconds to make your plays.) Once the preliminaries are decided, it's time to play ball!



The computer always starts the game by kicking off. This is the only break you can count on the computer giving. From then on, it is unmerciful. After you have returned the kickoff, you choose from eight offensive formations. You can run almost any play you can think of from these eight basic formations. Just remember the 15- or 30-second play selection time.

The referees also give no breaks. They will deal out "delay of game" penalties all day. The onscreen scoreboard gives indications of the plays. It shows the penalties along with other good and bad announcements — "Punt in the Air," "Ball Is Snapped," "Completed Pass," etc. So there are many things to do and watch out for, so many things going on at the same time. You can watch the left half of the screen as the defense smothers you. You could really use an extra pair of eyes in order to track all that is going on. It's going to take some long hours with a joystick in hand to master this one.

Football II requires a CoCo 3 and a joystick, a TV or a monitor. However, I found the detail on the TV not very sharp at all, and this makes the game even more difficult to follow. It is hard enough with a monitor on which you can see everything going on. For a TV, I would have rather had just the overhead view increased in detail. So, I highly recommend running the game with a monitor, not a TV. Overall, I find the game very challenging.

(Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX 76102; $29.95: Available in Radio Shack stores nationwide.)

—Dale Shell

Software CoCo 1, 2 & 3

Yahtzzz and *Quantum**Leap*— Take-Offs on Dice Games

I was pleasantly surprised when I came home from work and found a package from RAINBOW waiting on the table — *Yahtzzz* and *Quantum**Leap* from JR & JR Softstuff. I sat down in front of the CoCo, poked a disk in the drive and made the recommended backups. Yes, that's right, these programs are not copy-protected, and the publishers recommend making backups. In fact, the original diskettes come with write-protect tabs already in place, to prevent accidents. And since both programs maintain a high-score log on the program disk, they *must* be backed up before playing.

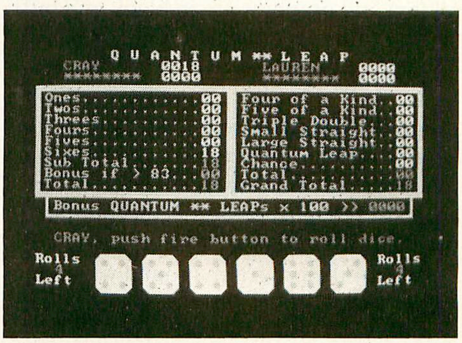
Yahtzzz, as you might have guessed from the title, is a clone of a popular dice game. *Yahtzzz* requires a 32K CoCo 1, 2 or 3. A score sheet is placed on the screen, along with five dice. The keyboard or joystick is used to roll, to discard dice and to pick the scoring box to enter the result in. Almost everyone has played this type of game at some time, in some incarnation. *Yahtzzz* is programmed in BASIC, with some machine language routines.

*Quantum**Leap* is a somewhat similar dice game for the CoCo 3. It uses the 16-color screen, mixing text and graphics with lots of colors. On startup, you are asked if you are using an RGB or a composite monitor, and then you are thrust into the game. Once in, there is no way out without either playing a complete game or pressing the reset button.

The biggest difference between *Quantum**Leap* and *Yahtzzz*, though, is that *Quantum**Leap* is played not with five dice, but with six! As you can imagine, this changes the strategy of play more than a little...but lest things get *too* impossible, you are allowed four rolls instead of three to try to accomplish your scores. Scores are much higher, and some of the rolls are *much* more difficult.

Since *Quantum**Leap* is strictly for the CoCo 3, I ran it first. I quickly discovered that something in the machine language of the game conflicts with modifications I routinely load into Disk BASIC when I start up my CoCo. However, when I rebooted and ran the program from unmodified Disk BASIC 2.1, everything worked OK.

The game is fun, interesting and much fresher than I would have expected from yet another *Yahtzee* clone. The six dice make more difference than I would have credited at first glance. On completion of a game, the score is automatically entered in the "Top Ten" and saved to disk.



```
          Q U A N T U M ** L E A P
   CRAY          0018       LAUREN        0000
   ********      0000       ********      0000
 Ones..............00   Four of a Kind..00
 Twos..............00   Five of a Kind..00
 Threes............00   Triple Double...00
 Fours.............00   Small Straight..00
 Fives.............00   Large Straight..00
 Sixes.............18   Quantum Leap....00
 Sub Total.........18   Chance..........00
 Bonus if > 83.....00   Total...........00
 Total.............18   Grand Total.....18
   Bonus QUANTUM ** LEAPs x 100 >> 0000

     CRAY, push fire button to roll dice.
 Rolls                                   Rolls
   4                                       4
 Left                                    Left
```

Eyestrain might get to you unless you try the RGB color set; it is much more readable on my monitor. The only other difficulty with *Quantum**Leap* arose when I left it for my wife to play with during the day. I came home to discover she had been unable to get the program to load. There was a minor error in the instructions, telling users to `LOADM"QUANTUM**LEAP"`

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— a command any seasoned hacker would have instantly recognized as erroneous, but which could trip up beginners.

When I ran *Yahtzzz*, I tried it both on the CoCo 3 and on my backup machine, a CoCo 2B. I found, first, that CoCo 3 users who have RGB analog monitors will see this game in black-and-white because it uses the artifact color set. This will not affect play of the game, however, because all text and graphics are in black and buff, and will display adequately regardless of display options.

The second thing I found was that the program would crash immediately on finishing the first game whenever I ran it on the CoCo 2, but would change to high speed at the same point when running on the CoCo 3. When I listed the BASIC portion of the program, I found what I had suspected: `POKE 65497`, a CoCo 3 high-speed poke. This is an easy error to make when developing programs on a CoCo 3 to be run on an older CoCo, since the old poke to 65495 will not work on the CoCo 3. Furthermore, the user is not even prompted for use of the high-speed poke, even though many of the older CoCos will lock up when it is used. Fortunately, anyone who is aware of this situation can fix the problem very easily by removing the offending pokes wherever they appear, because the BASIC portion of *Yahtzzz* is not listing-hidden.

Also, *Yahtzzz* turned out to be incompatible with my modified BASIC, but that was no real surprise — the modifications I installed use practically every byte of memory not used by the BASIC interpreter itself. When I rebooted, I found that *Yahtzzz*, too, was stable and bug-free, both with keyboard and with joystick, when running under both Disk BASIC 2.1 and 1.1, aside from the already mentioned high-speed problem. [JR & JR Softstuff has reported that these bugs have been fixed in a corrected version.]

With *Quantum**Leap* priced at $19.95, and *Yahtzzz* at $12.95, neither game is priced too high for the entertainment delivered. The first time I loaded the games, I found myself playing for nearly four hours, just trying to get the Quantum Leap — six of a kind. While I have seen a five-dice game in the public domain, the graphics and sound are nothing to compare with *Yahtzzz*, and I have never seen a six-dice game from any source.

(JR & JR Softstuff, P.O. Box 118, Lompoc, CA 93438, 805-735-3889; $19.95 for *QuantumLeap*, $12.95 for *Yahtzzz*, $3 for S/H)**

—Don Qualls

Hardware

Disto Assortment— A Smorgasbord of Products

Our friends at CRC/Disto have released a variety of hardware products for the CoCo. Included in this group are Super Controllers I and II, the RS-232 Super Pack, the RS-232 Switcher, and an RGB-Mono Video and Audio Interface. All of these products are worth considering if you are in the market for hardware additions for your CoCo.

> ***"The RGB-Mono Video and Audio Interface is a fine product and provides much better video resolution on a composite monochrome monitor than is available through the composite jack on the back of the CoCo 3."***

Super Controller I: a floppy disk controller that employs the latest state-of-the-art technology and is compatible with all versions of the Color Computer. It is housed in a rugged metal case, utilizes gold-plated contacts and the Western Digital WD1773. It contains four 28-pin sockets, which can be fitted with either 2764 or 27128 EPROMs, and comes with C-DOS installed. Each socket is software-selectable with a simple `POKE 65345`,*x* (where *x* is a number between zero and three).

There are no adjustments to be made, so nothing needs to be calibrated to maintain reliable operation. The Super Controller I also incorporates a mini-expansion bus connector that lets you add other Disto products (i.e., a real-time clock calendar, a hard disk adapter, an EPROM programmer and other user-oriented projects). As an option, you can add a parallel printer port that can be used with a Centronics-compatible printer under OS-9. The controller operates at 16 MHz, so it's fast. It needs only +5 VDC, which it picks up from your CoCo's expansion slot or Multi-Pak Interface. Because it doesn't need the 12 volts used on the older CoCo disk controllers, it doesn't draw as much current.

Although the Super Controller I is memory-mapped to be compatible with the Radio Shack controller, it has differences that accommodate the extra features. The controller's 10-page instruction booklet shows the memory map and SCS select pin. The I/O select is mapped at $FF40 (65344) to $FF5F (65376).

Each of the four available sockets is made to use either an 8K EPROM, like a 2764, or a 16K EPROM 27128. If you use the high-speed poke, the maximum access time for the EPROM is 300ns; otherwise, a 450ns EPROM will work. Each of the sockets will access either 8K or 16K, depending on whether an 8K or a 16K EPROM is used. The memory map of this area is from $C000 (49152) to $FEFF (65279) for a 16K EPROM and $C000 (49152) to $DFFF (57343) for an 8K EPROM. Since all four sockets are mapped to the same area, only one chip can be active at any time. The active-chip byte determines this. Any socket and DOS can be selected at any time even from within your BASIC or machine language program. Although specific instructions are provided on how to do this, I prefer to boot up a specific DOS from a warm start.

The Super Controller I is a fine product and will provide even the most demanding CoCo user with fast and reliable disk operation. It sells for $99.95.

Super Controller II: This controller is similar to the Super Controller I but contains only one 24- or 28-pin socket for an 8K ROM or EPROM or for 16K EPROMs. It too incorporates an internal mini-expansion bus for any of the available Disto add-ons. The big difference, however, is that under OS-9 this controller uses a buffered read/write scheme to allow read/write I/O without halting the computer's CPU. This translates into *speed* as well as continual use of the CoCo keyboard — even while the disk is reading or writing. It also means that the system clock will no longer lose time during these read/write operations. The controller is completely interrupt-driven to allow fast, smooth multitasking operations — something some PC compatibles can't do.

The Super Controller II is the best choice if you are into OS-9 programming. It sells for $130.

RS-232 Super Pack: This is Disto's answer to the Tandy Deluxe RS-232 Pak. It is housed in a black plastic case only about half the size of the older Tandy product but containing no software. I tried the Disto Super Pack with *MikeyTerm*, *Greg-E-Term* and *RickeyTerm* and was very impressed with its operation. It requires the use of a Multi-Pak and provides a true RS-232 serial port.

Although I did not try it with OS-9, Disto claims its Super Pack is compatible with OS-9 ACIA software. It comes ready to go and includes a DB-25 cable. My only complaint is that the supplied cable is about 8 inches long. I'd like to see it about 3 feet long, so it could be plugged right into my modem without requiring an extender cable.

The RS-232 Super Pack sells for $49.95.

RS-232 Switcher: This handy gadget is a must if you use a serial printer along with a modem or other serial device. It's housed in an attractive off-white case to match the color of the CoCo 2 and 3. A three-position rotary switch is used to select any one of three serial devices. Four 3-foot cables are routed out the back of the switcher, and each is terminated with the appropriate DIN connector. One of the cables has a male DIN connector that plugs into the back of your CoCo serial port. The other three cables have a female DIN connector, so your serial-to-parallel adapter can be hooked up. The box measures 4.5 inches long, 2.5 inches deep and 1.25 inches high. The RS-232 Switcher sells for $19.95.

RGB-Mono Video and Audio Interface: This product is made just for the CoCo 3 and lets you use a composite monochrome monitor with that Color Computer. What's different here is that while you can hook a composite monochrome monitor directly to the back of the CoCo 3, the computer puts out a color signal. Although this is satisfactory, it is not as good as what you can get using this gadget. This interface plugs into the 10-pin RGB socket on the bottom of the CoCo 3 and provides exceptionally crisp, clear text or graphics.

In addition, this interface has a built-in speaker and volume control, so you can obtain sound at the same time. Although the results are worth the effort, you do have to open your CoCo 3 case to add this interface. If you are concerned about this, it may be best to wait until your warranty has expired and then get a friend with technical experience to help out. A little red clip has to be connected to a diode inside the computer. The directions are quite clear, and I had no trouble making this solderless connection. The interface itself is 4 1/2-inches long, 2 1/2-inches wide and 1 1/2-inches high, and it sits outside the computer. Three cables come out of one side of the off-white plastic case. While the one with the red clip is about 2-feet long, the one that plugs into your monitor's composite video jack is almost 6-feet long and has a standard RCA plug on the end. The last of the three is a 2-foot, 10-conductor ribbon cable, which plugs into the RGB connector on the bottom of your CoCo 3. After it's all hooked up, there's plenty of cable length to allow you to put the interface in a convenient spot near your computer.

The RGB-Mono Video and Audio Interface is a fine product and provides much better video resolution on a composite monochrome monitor than is available through the composite jack on the back of the CoCo 3. It sells for $29.95.

All of these Disto products performed as advertised and were well documented. The quality is first class, and I see no

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—Robert Gray

Software CoCo 3

Leonardo's Paintbox— What Would da Vinci Have Done With a CoCo 3?

Do you hate trying to program Hi-Res graphics in BASIC? I mean, do you really hate spending hours plotting and planning down to the last point to keep the `PAINT` from going outside the lines? Have you had it with trying to figure out your starting point to make sure the whole picture fits and then finding out it won't? Wouldn't you love to sit down with your joystick, draw the picture and have the BASIC program magically appear on your disk? If you answered "yes" to any of these questions, get ready to open *Leonardo's Paintbox* because — believe it or not — this little program lets you do just that.

Requiring a CoCo 3, 128K and a disk drive, *Paintbox* is accompanied by six unassuming pages of instructions. The recommended drawing tool is a self-centering joystick. The instructions are broken into five parts: Starting the Graphic, Drawing Mode, Painting Mode, Adding Dots of Color and Saving the Graphic.

Starting the Graphic is just that: You center your joystick and then select 16 colors from your palette to use when creating your drawing.

Moving on to Part 2 is really complicated — press the space bar. You are now ready to draw. (Like I said, *really* complicated.) Drawing is accomplished by moving the cursor to the starting position on the screen. To draw, press the red fire button, and you're drawing. To stop drawing, let go of the button. Did someone say you can't use Radio Shack's joysticks for Hi-Res? Wrong! I used not only my standard sticks, but an Atari stick and even a Koala pad — all with good results. You can even draw from the keyboard for point-by-point accuracy. If you do manage to make a mistake, there is an Undo feature to undo your mistake. Finally, a Redraw option lets you redraw the picture from the beginning to repair gaps that may occur if your "undo" line crosses another line.

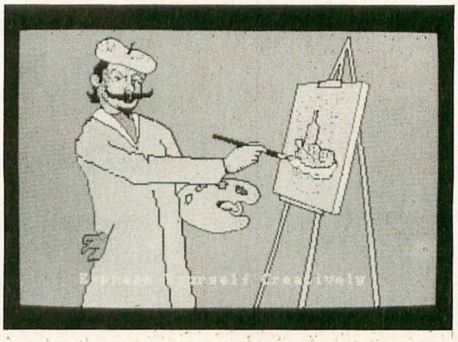
Let's move on to Part 3, painting. This is the hard part, right? True, it's more difficult than pressing the space bar. Now you must press and hold F1 until the Part 3 title appears. Next, press the space bar, and you're ready to paint. Your palette of 16 colors, located at the bottom of the screen, is ready for you. Use the joystick to select a color and then move the cursor to the area to be painted. Press the firebutton again, and it's painted. What if the paint spills into the next area? No problem. Use Redraw to return to the draw mode and plug the "leak." Now press F1 to return to the Paint mode.

Have you finished painting? Then it's time to learn a new command. Press F2 to leave the Paint mode, and you're ready for Part 4 or 5. If you are satisfied with your picture, you can save it, or you can add texture, shading, highlights and more detail to your graphic by using the dots of color available. Again, simply click onto the color of your choice, using the stick or the keyboard to place dots of color on your graphic. This really gives the graphic some style.

When do we get to the hard part? Hold on, it's coming. To save the graphic, press B. You are now asked for a name for the picture. Type in your selected name and press ENTER. *Paintbox* begins writing the BASIC program — in ASCII format — to your disk.

Now for the hard part.

The instructions ask you to wait while the program is created. I found this to be the hardest part. I hate to wait for anything! The more complex your graphic, the longer this will take. It took about two minutes for the drawing I made. Once the program is created and stored on disk, you'll be asked if you want to run the BASIC program.



If you press Y, the program runs, and your graphic is reproduced from BASIC using `PALETTE`, `HDRAW`, `HPAINT` and `HSET` commands with variables stored in data statements within the routine, or in a separate data file saved on the disk along with the routine.

Is there anything this program can't do? Unfortunately, yes. There is no easy way to clear the screen and start the drawing over again. To start over, you must reach back to the old reset button and rerun the program. A one- or two-keystroke command, like CTRL-C, to clear the screen would have been a lot more convenient.

Now if — like me — you have no artistic talents, you probably think you can't do anything with *Paintbox* because you can't draw. Wrong again. One of the helpful hints on the last page of the instructions suggests tracing a picture on clear plastic wrap and using it as a guide. I traced a picture from my daughter's coloring book onto a clear plastic sheet, placed it on the monitor screen and used *Paintbox* to trace the tracing. I couldn't believe my eyes. I *can* draw. (Is this fantastic or what?) This is a great program and worth the price.

(E.Z. Friendly, 118 Corlies Ave., Poughkeepsie, NY 12601, 914-485-8150; $26.95 plus $1.50 S/H, introductory price; $29.95 regularly)

—Randy Cassel

Software CoCo 1, 2 & 3

I Ching— The Whims of Fortune

I know, I know. You don't *really* believe in this fortune-telling stuff. You're a cosmopolitan person living in the 20th century. You know where you're going and you don't need anyone or anything to help you solve your problems or tell you where you're headed. You just bought this as a...*party game*. That's it. That's why I asked to review *I Ching*. I enjoy fortune-telling. It's a great ice-breaker — a conversation piece.

Sure it is.

According to an Eastern philosophy, our universe is bipolar (i.e., the universe is composed of opposites — light and dark, life and death, male and female, yin and yang). However, these opposing forces are not constant; the universe changes — night becomes day, and day becomes night again. Followers of this philosophy saw a pattern in these changes. They documented these changes in the *I Ching* — the *Book of Changes*. By asking questions and tossing sticks, which symbolized the opposing forces of yin and yang, these people believed they could predict future events — see the pattern of change in their futures.

The people at Tothian realized that this pattern of change was binary in nature and that it would be simple to emulate this pattern with the Color Computer. With this in mind, they created *I Ching*, which runs on any 32K CoCo (disk or tape). The program offers five different ways to peer into the future (or break the ice at a party), and onscreen instructions make it easy to use. In addition, the program's documentation offers a brief history of the *Book of Changes*. The manual explains the various symbols and how this manner of divination works.

Like any fortune-teller, CoCo cannot gaze into your future without help from you. The program requires user response. You are offered five options for determining the appropriate responses. You may toss coins, use yarrow sticks, shuffle cards, swing a pendulum or use your intuition. In each instance, the program offers detailed instructions to the novice but lets the experienced user avoid the instructions and just enter the appropriate data.

I tried all the available options. I am lazy, so I preferred the simplest option, Option 5, which asks the user to enter six random numbers (from 1 to 100). Option 1, tossing coins, wasn't bad either because I only had to toss three coins six times — no problem, I had that much change in my pocket.

> ***"I asked if I would someday be rich and famous, entering the numbers as requested. The program then computed my hexagram (my present situation) and a second hexagram (my path of change — my future). It concluded with the hexagram representing initial difficulty but ultimate success. (And just think, you'll be able to say you knew me when....)"***

Option 3, which uses cards, required that I make four cards before I began, and the pendulum (Option 4) required that I draw a diagram and make a pendulum before I could start the process. Of course, none of these tasks was too difficult for someone who wanted to ponder the secrets of...um, I mean, *review* this program.

However, Option 2 was too time-consuming for me to try more than once. The program asks for 49 yarrow sticks, but it will settle for 49 of something else. I had a roll of pennies to use, so I gave it a try. This process requires an elaborate series of selections. Although the program supplies instructions, you must complete this process of elimination *six* times. OK, maybe I want to know the secrets to the universe, but not *that* much.

Once you have entered all the requested information, the program determines the two hexagrams representing your present and future conditions. For instance, I asked if I would someday be rich and famous, entering the numbers as requested. The program then computed my hexagram (my present situation) and a second hexagram (my path of change — my future). The program responded with the hexagram representing incomplete action (i.e., I haven't started on the path to wealth). It concluded with the hexagram representing initial difficulty but ultimate success. (And just think, you'll be able to say you knew me when....) The program's an-

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swers are, of course, rather cryptic, but you can use them to formulate your own theories about the future.

When you have seen the results, you can save the judgment in a file or add it to a previous file. You also have the option to print a copy of the program's prediction. Finally, you can review earlier prophecies and edit them. Yes, that's right. You can change the hexagrams the question originally offered to something you find more suitable. Who says you can't change the future?

(Tothian Software, Inc., Box 663, Rimersburg, PA 16248; $24.95.)

—Beth Haendiges

Hardware CoCo 1, 2 & 3

SolidDrive— Get Six Floppy Drives on a Card

Imagine turning on your CoCo and in less than two seconds — with no disks clattering and rumbling — having 1 megabyte of disk space available, running with sub-second response faster than even a hard drive. Now imagine grabbing a metal cartridge the size of a disk controller and taking it to work with you to use on your OS-9 system at the office.

That's not good enough for you?

OK. Turn on the computer again, but hold down the space bar this time. There you are in Disk BASIC — SolidDrive Version S1.1. Now you have six floppy disks available to you, drives 4 through 9. Go ahead. Run your graphics programs at blistering speed. Edit text faster than you could have imagined. Is this a CoCo? Now take the pack out and go to a friend's house to show him or her your new desktop publishing creation.

Still not good enough?

OK. Let's run a little utility that'll format a megabyte of RAM disk in under 30 seconds. Now let's split it up: three logical drives, say — 4, 5 and 6 — to RS-DOS, and drives 7, 8 and 9 to OS-9. You have Level I at home and Level II at work? No problem. Split it any way you like. Have a separate boot file for each.

This is no fantasy. This is SolidDrive from Vidicom Corporation, a fast-access, high-speed RAM cartridge that can be configured for either half a megabyte or a full megabyte of RAM to emulate either three or six floppy disk drives. It is not an "actual" disk drive but a hardware cartridge that plugs into a Multi-Pak Interface or a Y-cable; it consists of RAM chips and circuitry. There are also several software programs required to make SolidDrive work; also available is an optional EPROM chip for your disk controller to make SolidDrive come to life when you start the computer.

SolidDrive is not a "real" disk drive — it just thinks it is. In actuality it is a bank of RAM chips organized in such a way that they are split up and assigned disk drive numbers, just like real disk drives. With a conventional disk drive (and OS-9 users know this all too well), when you ask the computer to go and get something or to load something or store something, you're in for a wait. Like a tired old janitor, it tells the disk drive to wake up, then goes and seeks (and seeks and seeks) a program or a file, and then loads or saves it, and then unloads what it loaded...you get the picture. Even with a hard drive running at 10 times the speed of a floppy drive, multiple seeks, reads and writes take time.

The RAM chip, however, is online and standing by, as if it were already in memory. If it is not, but needs to be loaded, there is no mechanical or physical process involved: We simply have a circuit-to-circuit transfer that no electro-mechanical process can match, because what you are looking for is already there! It is for this reason that a super-fast RAM cartridge can be called the Jaguar of disk drives. In addition, the SolidDrive has an on-board battery backup, so you won't have to worry about a power failure or accidental power-down. The moment power is removed from the system, SolidDrive write-protects itself, keeping all the data alive and well. Just plug it into a cartridge slot again, and off you go. The battery is good for at least two years, and the unit will shut itself down several days before critical power loss, allowing you time for battery replacement.

SolidDrive can be used for OS-9 and Disk BASIC both. It fills the gap between the hard drive and the floppy, or just boosts your floppy power with more speed and storage. Certainly in terms of users with applications that involve a lot of disk access, like programs that deal with integrated text and graphics. It can really boost productivity with its reliability, speed, storage and portability. OS-9 users who are relying heavily on applications that go through a lot of disk seeks and reads would find this an invaluable tool, and in conjunction with a hard drive, well, it could probably beat the pants off most PCs! If you are an OS-9 power user, this product is most definitely for you.

SolidDrive comes with excellent, well-organized documentation in *extra large print*. It tells you everything you need to know about installing and using SolidDrive, from how to change its memory locations to how to use it in auto-boot mode. It gives you hints on allocating drive space and even troubleshooting. Vidicom Corporation warranties SolidDrive for two years with a limited warranty. You are invited to call the company if trouble arises that you cannot handle. A word of caution to the curious: Breaking the case seal will void the warranty!

Inexperienced users should be careful when allocating which logical disk drives are to be used for Disk BASIC and which for OS-9 if you intend to use both operating systems. There is a utility included with SolidDrive called `SMap`, but as is the case with all utilities, one must know how to use it properly! It is possible to confuse the software in such a way that you would need to reformat SolidDrive. Careful planning will avoid this risk.

For those users who want SolidDrive available the moment they turn the CoCo on, there is an optional EPROM for $19 that can be purchased from Vidicom. You can also load the software drivers from disk, but this will not give you instant access to SolidDrive. Be sure to specify either the 24- or 28-pin EPROM when ordering. I highly recommend the EPROM. If you are investing in the SolidDrive, the EPROM is a must.

I think this is an outstanding product. I received my unit with physical damage in evidence (probably from dropping or banging), but when I plugged it in it worked flawlessly and has continued to do so ever since. This is one tough, reliable unit, and it is a must for serious users. For those who cannot or do not want to make the investment in a full megabyte of memory, the unit can be later upgraded at the factory. When you consider the cost of the equivalent hard drive or multiple floppy disk drives, this is an excellent value for the money. The service available when problems arise is excellent. I had a damaged disk and a wrecked EPROM, along with the damaged unit when it arrived; after a quick, courteous and helpful phone conversation with the owner of Vidicom, I received replacement equipment the next day, and it functioned flawlessly. This company and its products are a model for the entire CoCo Community. On a scale of 1 to 10, this product rates a 10.

(Vidicom Corporation, 20 E. Main St., Suite 710, Mesa, AZ 85201, 602-827-0107; $395 for 512K version, $695 for 1-Meg version, $4 S/H)

—Jeffrey S. Parker

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The following products have recently been received by THE RAINBOW, examined by our magazine staff and issued the Rainbow Seal of Certification, your assurance that we have seen the product and have ascertained that it is what it purports to be.

Black Grid, a computer adaptation of the "Black Box" game in which the computer hides from two to nine blocks inside a black grid. Players must locate them by shooting "rays" into the grid. Three different play modes are available. Requires a CoCo 3 and a disk drive. *SPORTSware, 1251 S. Reynolds Road, Suite 414, Toledo, OH 43615, (419) 389-1515; $21.*

Calendar and Convert, two OS-9 Level II programs on one disk. *Calendar* (32K required) creates an 800-year calendar for the years 1600 through 2400. Printing out selected monthly calendars requires a printer capable of elongated type. *Convert* (24K required) is a utility to convert numbers to and from decimal, binary and hexadecimal. It also converts ASCII characters to decimal, and decimal to ASCII. Both programs create and erase their own overlay windows; they come on a 35-track disk. *Alan Hanusiak, 37 Grand Ave., Rockville, CT 06066, (203) 875-2027; $24.*

CoCo 3 Wheel of Fortune, an upgrade of the CoCo 2 version of the popular TV game show. (The CoCo 2 version is still available.) Requires a CoCo 3 and a disk drive. *SPORTSware, 1251 S. Reynolds Road, Suite 414, Toledo, OH 43615, (419) 389-1515; $21.*

CoCo Stereo Headphone Amplifier, an audio amplifier that plugs into the rear cassette port. It makes game sounds or music audible through one or two headphones that have 1/8-inch stereo plugs (headphones not included). For the CoCo 1, 2 and 3. *Mike Forrest, 2501 Summer Tree Lane, #1096, Arlington, TX 76006, (817) 860-3885; $39.95.*

◆ **Disk Handyman**, a CoCo 3 disk utility that performs 128/512K backups for one- or two-drive systems, and can perform backups between two Drive 0s using the Multi-Pak Interface. It will also verify a disk, encode the DOS track to auto-start a program, and "lock out" bad granules, permitting use of a disk with errors. *Micro Data Systems, P.O. Box 462, Princeton, KY 42445, (502) 365-0206; $24.95 plus $3 S/H.*

KJV Disk #35: The Book of Acts, the Book of Acts from the King James version of the Bible, in ASCII files. For the CoCo 1, 2 and 3 and a word processor. *BDS Software, P.O. Box 485, Glenview, IL 60025, (312) 998-1656; $3.*

Lyra 2.6, an upgraded version of the menu-driven CoCo music composition program that can work with MIDI. A graphic display allows entry and editing of a music score with up to eight independent parts. Requires any model CoCo that has at least 64K, a disk drive (Disk Extended Color BASIC 1.0, 1.1, 2.0 or 2.1) and a mouse or joystick. Optional equipment includes a MIDI synthesizer and a connecting cable. *Rulaford Research, P.O. Box 143, Imperial Beach, CA 92032, (619) 690-3648; $59.95.*

Nine-Digit Calculator, a BASIC program that emulates a handheld, nine-digit calculator. It uses Reverse Polish Notation, with an entry pad, a six-register stack and 100 memory locations. For the CoCo 1, 2 and 3. *BDS Software, P.O. Box 485, Glenview, IL 60025, (312) 998-1656; $10.*

Omni Utility, a menu-driven disk utility that offers such functions as printing and alphabetizing disk directories, performing backups, editing sectors, and copying, moving, executing, killing and renaming files. For the CoCo 3. *GSW Software, 8345 Glenwood, Overland Park, KS 66212, (913) 341-3411; $20.*

Public Domain's Disk #22, a collection of 32 public domain games, including *Othello, Subchase, Gammon and HogJowl.* Other disks available; send $1 for a catalog. *Public Domain Software Copying Company, 33 Gold St., Suite L-3, New York, NY 10038, (800) 221-7372; $10 plus $4.50 S/H.*

◆ **Simply Better**, A command-driven CoCo 3 word processor with pop-up windows. Features include onscreen underlining, a window allowing two documents to be open at the same time, index and table of contents creation, macros, sorting, display of five print fonts, forms fill-in, automatic print spooling, a spelling checker, mail merge and more. On the 128K CoCo 3 it provides 90K of text storage; on the 512K it provides 480K. *Simply Better Software, P.O. Box 20726, Portland, OR 97220, (503) 254-7225; $29.95.*

◆ **WHEELER.BIN and GAMEGEN.BIN**, two machine language programs for lottery players. `WHEELER.BIN` lets users wheel from seven to 19 different numbers for their state's lottery games. `GAMEGEN.BIN` outputs random games. For CoCos 2 and 3, disk drive required, printer optional. *Davisson, 13733 Celestial Road, Poway, CA 92064, (619) 748-7441; $19.50 plus $2.50 S/H.*

Zebra's Picture Disks #2, #3 and #4, a set of disks each containing 120 pictures for use with *CoCo Graphics Designer Plus, CoCo Graphics Designer, CoCo Max, CoCo Max II* and *Max-10.* An instruction manual and 15 custom disk labels are provided. Each disk covers four "topics": Disk 2 — Sports, America, Party and Office; Disk 3 — Animals, Nature, Religion and Travel; Disk 4 covers holidays — Popular, National, Christian and Jewish. Upgrades from earlier picture disks are available for $5 plus $3 S/H and return of the original, serial-numbered disk. *Zebra Systems, Inc., 78-06 Jamaica Ave., Woodhaven, NY 11421, (718) 296-2385; $14.95 each plus $3 S/H.*

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The *Seal of Certification* is open to all manufacturers of products for the Tandy Color Computer, regardless of whether they advertise in THE RAINBOW.

By awarding a *Seal*, the magazine certifies the program does *exist* — that we have examined it and have a sample copy — but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to THE RAINBOW reviewers for evaluation.

—Lauren Willoughby

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This is a sample of the dot-matrix printer output from the OS9 Calligrapher set to full-justify the text within a 2.1 inch wide column. The font used is the 11-point Prestige font from the font set #15 or font package #5.

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BASICally Q&A Speaking

By Bill Bernico
Rainbow Contributing Editor

The Start of Something Big

Dear Bill:

I have a 128K CoCo 3 and Magnavox 8-CM515 monitor. I'd like to write a slot-machine game, but I'm not quite sure where to start. Any help you can offer would be appreciated.

Harold Tetzlaff
Jasper, Tennessee

Here's a 21-line program (Listing 1) to start you down the path to the programmer's hall of fame. It contains enough information to provide the core of a pretty good slot-machine game. You'll have to spruce up the graphics to make the slot machine *look* like a slot machine. I've also left the scoring and prize-collection routines in your hands. All I want to show you is a way to make the different symbols show up in the three windows.

For my example, I've used plain circles with the numbers one through seven in them. You'll want to substitute pictures of cherries, oranges, lemons, bells, etc. in place of these circles, but the procedure for storing them will be about the same.

First, in Line 10 I've set the screen resolution, cleared it to white and defined my foreground and background colors. Next, in order to store my seven symbols or circles, I have to define their buffers. Since I'm using seven circles (pictures in your case), I have to define buffers one through seven and describe their size. This is done in Line 20. I could have written the following:

```
20 HBUFF 1,300:HBUFF 2,300:HBUFF
3,300 (etc.)
```

However, I decided to save a little space and memory by putting all seven in a loop.

My next step would naturally be to draw each of the seven pictures and then store them in their respective buffers for later use. Again, I could have drawn and painted and stored each one on its own line, but to save space I used a `FOR/NEXT` loop again. In either case, the steps are as follows: `DRAW` the object and `PAINT` it. `HGET` the area around the object, clear the screen and then move on to the next object.

After you `HDRAW` and `HPAINT` the first object, you have to `HGET` that object and number it like this:

```
HGET (24, 0)-(44,20),1
```

The next object would also go through the `HGET` routine, but you'd end up that statement with a 2, and so on.

Line 90 draws a simple window for your objects to appear in. You must retrieve your objects from their buffers and position them in those windows. The three windows are filled by lines 100 through 110, 120 through 130 and 140 through 150. The even-numbered lines put the objects in the windows while the odd-numbered lines make the clicking sound and include a `GOSUB` to the pause routine.

In order to make each object appear at random in a window, you have to use `RND(7)` after the `HPUT` command. That will retrieve one of the seven pictures and place it in the window. Line 160 is a counter, which makes the objects shift ten times before the program jumps to Line 200. There, a prompt appears on the screen telling you to press ENTER to simulate pulling the one-armed bandit's lever.

Line 210 pauses, clears the screen and sets the counter (`A`) to zero before returning to Line 90 to start spinning the windows again.

There's your core, Harold. I'll be looking forward to seeing your completed slot machine in the near future.

Listing 1: `SLOTCORE`

```
10 HSCREEN2:HCLS4:HCOLOR8,4:RGB
20 FOR B=1 TO 7:HBUFF B, 300:NEXTB
30 FOR C=1 TO 7
40 HCIRCLE (35,11),9
50 HPAINT(35,11),C,8
60 HPRINT(3,1),C
70 HGET(24,0)-(44,20),C
80 HCLS 4:NEXT C
90 HDRAW"BM46,46R90D30L90U30R30ND30R30D30"
100 HPUT(50,50)-(70,70),RND(7),PSET
110 EXEC 43345:GOSUB 180
120 HPUT(80,50)-(100,70),RND(7),PSET
130 EXEC 43345:GOSUB 180
140 HPUT(110,50)-(130,70),RND(7),PSET
150 EXEC 43345:GOSUB 180
160 A=A+1: IF A=10 THEN 200
170 GOTO 100
180 Y=RND(40)
190 FOR X=1 TO Y:NEXT X:RETURN
200 HPRINT(3,20),"Hit (ENTER) to pull lever"
210 EXEC44539:HCLS4:A=0:GOTO90
```

Line Connections

Dear Bill:

For some time I have been trying to teach myself BASIC. *The CoCo 3 manual says the colon (:) may be used in place of a line number as long as the total characters following a line number do not exceed 249. On the basis of this, I have assumed that the converse is true (i.e., a colon may be substituted by a line number). I now find this is not true. In the November '88 issue of* RAINBOW, *Page 168, Listing 1, Line 220, if the colons are replaced by line numbers, the program does not run correctly.*

Can you please tell me under what conditions it is necessary to join two commands by a colon rather than sequential line numbers, or under what conditions you may not replace colons

---

Bill Bernico is the author of over 200 Color Computer programs and is a frequent RAINBOW *contributor whose hobbies include golf, writing music and programming. Bill is a drummer in a rock band and lives in Sheboygan, Wisconsin.*

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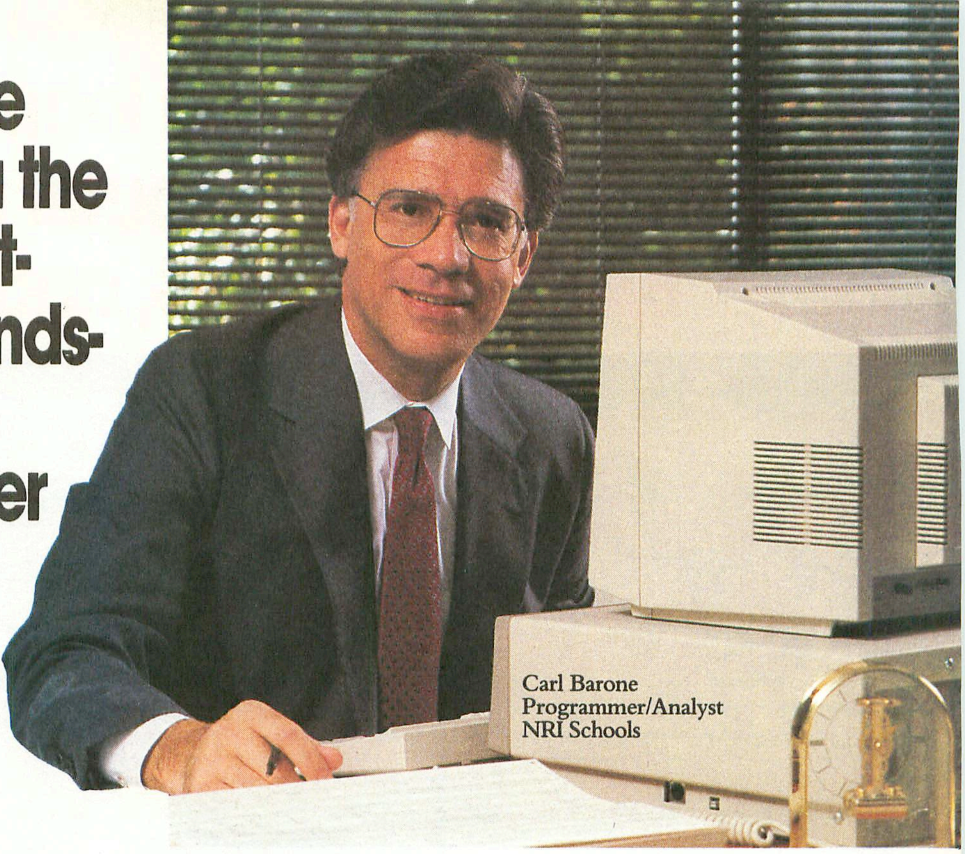

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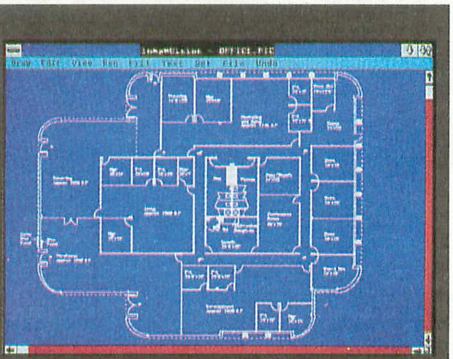
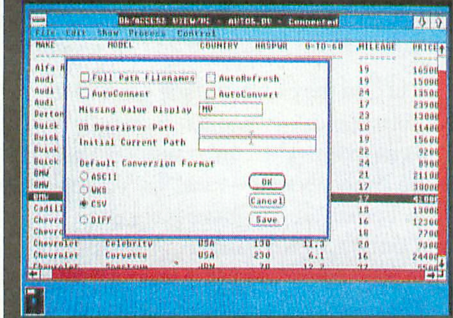


Next, you master Pascal, a multipurpose language often used to develop software for computer-aided design (CAD).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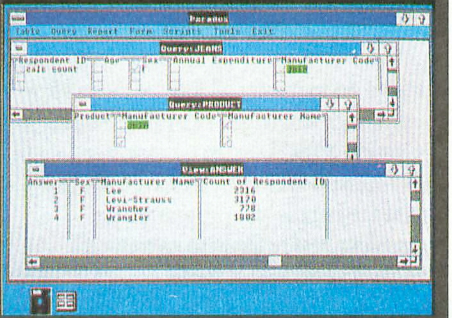

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with line numbers? It seems there is a subtlety of programming in BASIC *that is not explained anywhere I have looked so far.*

J.S. Smith
Ennismore, Ontario

It's nice to see that you don't simply follow the rules without questioning them. If you make a programming mistake and learn from it, it is worth the effort.

As a rule of thumb, you can combine commands on a single line with a colon, provided none of those commands has to work independent of the others. Look at the following example:

```
100 PRINT A$
110 IF B=2 THEN GOTO 350
120 C$=INKEY$:IF C$=""THEN 120
130 X=X+1:GOTO 70
```

In this example, these commands cannot be joined with a colon if you expect the program to branch accordingly. Now look at this modification of our example:

```
100 PRINT A$:IF B=2 THEN GOTO 35
0:C$=INKEY$:IF C$=""THEN 120:X=X+
1:GOTO 70
```

If the line looked like this, you'd have one heck of a time getting each command to work. In the first example, Line 110 contains an IF/THEN statement. Generally, you want to leave this type of statement in a line all its own. There are examples where several commands will work on the same line, but a logical step must be followed. You may combine IF/THEN statements in the following fashion:

```
110 IF B=2 THEN GOTO 350 ELSE IF
B=3 THEN GOTO 450 ELSE GOTO 110
```

The word ELSE provides an alternative if the conditions of the first part of the statement are not met. You could also have written this command in the following manner:

```
110 IF B=2 THEN GOTO 250
111 IF B=3 THEN GOTO 450
112 IF B<2 or B>3 THEN GOTO 110
```

However, this method uses up precious space and memory as well as three separate line numbers. Whenever you're working with a larger program where space and memory are likely to approach the limits, combine statements wherever you can. If the program is short and you want to include lots of REM statements and easily trace certain steps, it won't hurt to make separate lines out of each command.

Another problem with using colons is when a program branches *back* from a higher line number to a lower number. In Listing 1, Line 210 branches back to Line 90. If Line 90 had been combined with several other statements in Line 100, there would be nowhere for your program to go when it reached Line 210, resulting in a UL (Undefined Line) Error. This is a common mistake made when trying to condense an already-written program.

You can replace the colons from a combined statement with line numbers, provided those numbers are on their own lines. Look at the following modification of the first example:

```
100 PRINT A$ 110 IF B=2 THEN GOT
O 350
120 C$=INKEY$:IF C$=""THEN 120
130 X=X+1:GOTO 70
```

In this example when your program gets to Line 100, it prints out the contents of A$. You then get an error message because you're telling the computer to do something it doesn't understand.

There are quite a few examples of alternate programming not explained in the manuals. I guess it's similar to a dictionary not endorsing slang words and terms. You can get by with them, but it's not proper.

As far as the 249-character limit is concerned, you may be able to squeeze a couple more characters onto the line by typing EDIT *yy* (*yy* is the line number) and then pressing X to extend to the end of the line. This allows you to enter more characters but if you type RENUM, some lines may be too long and you'll lose the last character or two, so use caution with this method.

Keeping Score

Dear Bill,

I'm trying to write a CoCo 3 graphics program using the HPRINT *command to display a player's name and score. According to my CoCo 3 manual, you can write lines like this:*

```
HPRINT (0,20), "The Score is", SC

HPRINT (0,0), "Your name is"; A$

HPRINT (10,10), A$+B$
```

I've tried all of these samples and only the third one works properly. The only solution I can come up with is this:

```
HPRINT (0,20), "The Score is": HPR
INT(12,10),SC
```

While it does work, it takes a separate HPRINT *statement each time I want to display statistics. Is there an easier way?*

Owen Cornell
Twenty-Nine Palms, California

I think a bug crept into Tandy's files in Fort Worth. As written, the first two examples will not work. It's probably just a typo, but if you change the semicolon in the second example to a plus sign (+), it will display your name as well as "your name is." This will work providing that A$ was defined earlier in the program as containing your name. You must change the first example to:

```
HPRINT (0,20), "The Score is"+STR$ (SC)
```

By changing the numeric variable SC to a string variable, using the STR$ command, you make everything on that line compatible. If you wanted to add the score to the end of the last line you'd write:

```
HPRINT (10,10), A$+B$+STR$ (SC)
```

Or you may want to define the whole line early in your program with D$="Your Score Is:"+STR$(SC). Then when your program gets to the part where scores are displayed or updated, all you have to put is HPRINT (10,10),D$ and the text as well as the score will appear.

Questions about specific BASIC programming problems can be addressed to BASICally Speaking, THE RAINBOW, P.O. Box 385, Prospect KY 40059.

We reserve the right to publish only questions of general interest and to edit for brevity and clarity. We are unable to answer letters individually.

For a quicker response, your questions may also be submitted through RAINBOW's CoCo SIG on Delphi. From the CoCo SIG>prompt, type ASK for "Ask the Experts." At the EXPERTS>prompt, select the "BASICally Speaking" online form, which has complete instructions.

Adding input devices to an expansion board

Do You Read Me?

By Tony DiStefano
Rainbow Contributing Editor

Part 1 of this project (November '88, Page 157) explained the basics of start up. We started with a big project board and put two TTL circuits and a few LEDs on it. I used the first part of this project to show you how to output to the board and turn each LED on and off. In Part 2 (December '88, Page 146), I expanded the board to control things that required more current (like relays, buzzers and motors). This required another TTL chip like those used in Part 1 and an additional chip capable of carrying more current.

The first two parts of the project dealt only with outputs. You could turn devices on and off, but then you could not read the condition of the devices (like switches). In order to do that, you need a circuit able to read in data via the data lines D0 to D7. This, in turn, requires the proper decoding circuitry and a device that will buffer the switches. Study the circuit in Figure 1. It is a continuation of the circuit used in the last part of our project. In order to save space, I removed the details of the first and second parts. Any parts that will not be changed, I removed. The LEDs of Part 1 and the motors and buzzers of Part 2 have been removed. I left the buffer chips there, so you can see how the circuits work.

The first thing we need in order to be able to read in some data is a decoder able to decode the Read/Write (R/$\overline{W}$) line. Chip U2 of Figure 1 is the decoder chip we have been using. It is a 74LS138, a three-to-eight decoder. By now, you should be familiar with this chip, but let's review what lines are connected to it. The most important line is the SCS from the computer. This is connected to one of the *select* lines of U2, the G2B. This line is used to select a block of memory from $FF40 to $FF5F, which is the normal I/O area for disk drives. The second line going to G2A is an *address* line. Since this is an active low input, when A4 is low, the chip will be selected. When A4 is high, the chip de-selects. This limits our memory area to 16 bytes and leaves the other 16 for future expansions. The third connection to our chip is the E clock from the CPU. It connects to G1 of our chip. This is an active high input. So when the E clock is high, our chip is selected again. The E clock signal from the CPU is sort of a "data valid" indication. All data is valid when the CPU is writing to a device and the E clock is high. When the CPU is reading, the data is latched (or swallowed) on the falling edge of the E clock.

Those three signals control the selecting of the chip. The next three lines I describe determine which of the eight outputs will be selected, a three-to-eight decoder. Inputs A and B are connected to A0 and A1, respectively. Two address lines in binary represent four locations. The third line is connected to the R/$\overline{W}$ line of the CPU. Connected to the C input, it divides the eight outputs into two groups of four. The R/$\overline{W}$ line of the CPU is high for reading and low for writing. This makes one group a write-only select and another group a read-only select. Y0 to Y3 is the write-only group. We know this because we have already used two of the four lines with the controls for the LEDs and motors. The other group, Y4 to Y7, are read-only selects. We will use one of these read-only lines today, to read in data.

That takes care of the decoding part of today's project. We now have a read-only chip select. For the second part, we need a chip we can use as a buffer. Since this chip interfaces to the CPU's data bus, it must conform to some rules. The main rule is that when it is not selected, it must not interfere with the data bus. This condition is called *tri-state*. That means when the chip is not selected, it must be electrically disconnected (high impedance). Since the CoCo uses an 8-bit bus, we might as well use an 8-bit buffer. Looking through the TTL parts manual, I came across a chip that meets all our requirements — a 74LS244. It is an 8-bit, tri-state buffer.

U4 in Figure 1 is a 74LS244. It has eight outputs connected to the CPU's data bus. It also has eight inputs. These are our eight readable bits. Let's look at the two control lines. There are two because this chip can be controlled as both two 4-bit buffers and one 8-bit buffer. This makes the chip a little more versatile. For our project, we want it to be a single 8-bit buffer, so we will tie both control lines together. The TTL manual states that when the control line of a 74LS244 is high, the outputs are in tri-state mode. This is good because when the 74LS138 is disabled, all outputs are high. The manual also states that when the control line of this chip is low, the signal level appearing on the chip's inputs will appear on the chip's output. This is perfect for our project.

When the CPU is reading the proper location, the 74LS138 will respond by putting Y4 low. This will cause the 74LS244 to generate whatever level (high or low) it has on its inputs to the CPU. If we tied all the inputs of the 74LS244 to ground, the CPU would read $00 or all zeroes. On the other hand, if we tied the inputs to +5 volts, the CPU would read $FF or all ones. This is good, but soldering the wires to this chip every time we want to change the condition is a drag. Let's use a switch instead. SW1 in Figure 1 is a quad switch. The diagram shows that it is a PC board-mount DIP switch. This type of switch is generally found on a modem or printer as an option switch, and you can get them at a good electronic shop.

A switch is not the only thing needed for this project. You also need a resistor. Look at the diagram again, and you'll see why. One side of the switch is connected to the input of the 74LS244, and the other is connected to ground. When the switch is on, a direct connection to ground is made. The chip will see that as low, but when the switch is off, no connection is made anywhere. The input to the 74LS244 is just floating — a condition of uncertainty. When the chip is called upon to give the state of

---

Tony DiStefano is a well-known early specialist in computer hardware projects. He lives in Laval Ouest, Quebec. Tony's username on Delphi is DISTO.

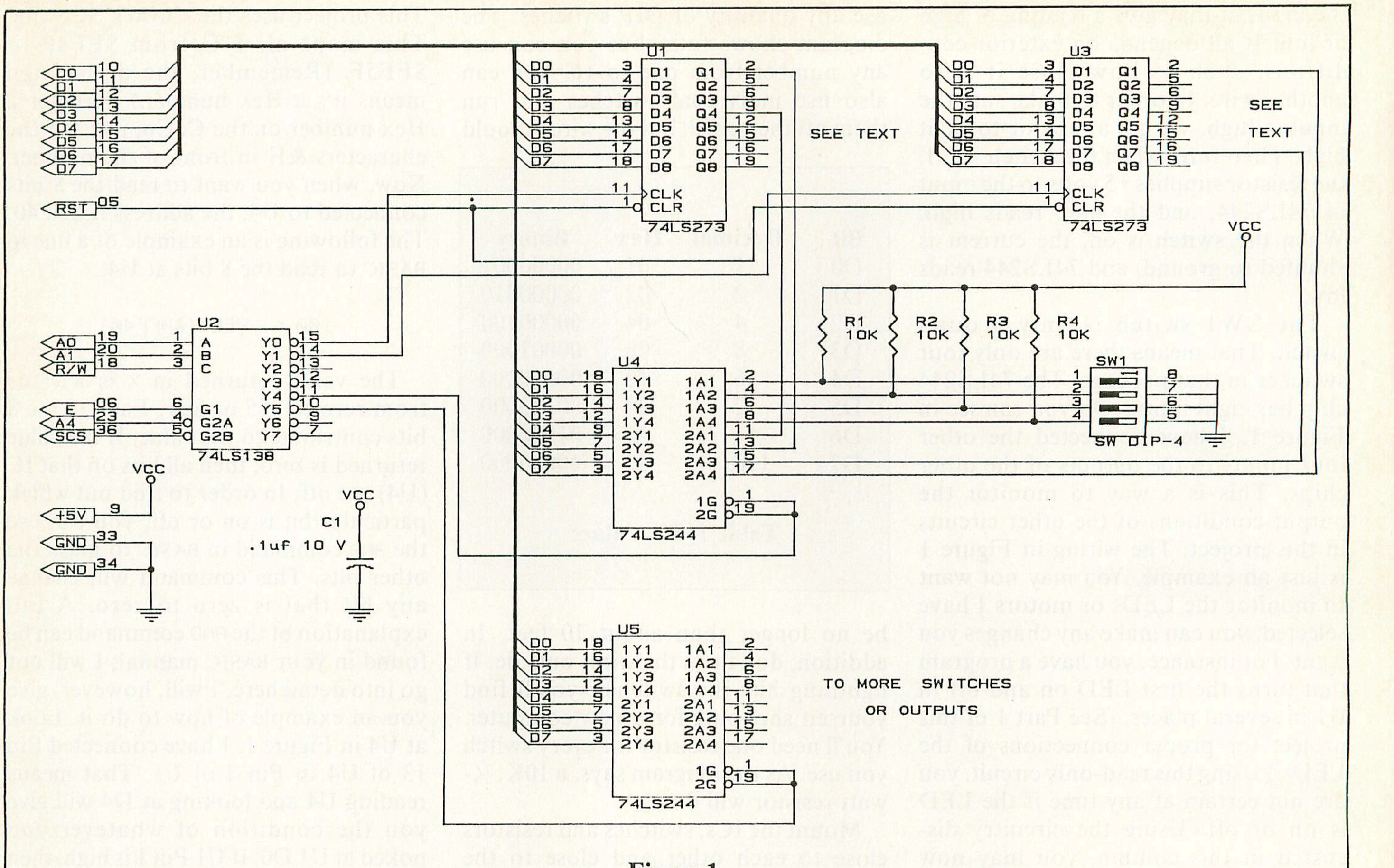
U1
74LS273
D0 D1 D2 D3 D4 D5 D6 D7
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8
CLK
CLR
SEE TEXT
U3
74LS273
SEE TEXT
VCC
U2
74LS138
A B C
G1 G2A G2B
Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7
RST 05
A0 19
A1 20
R/W 18
E 06
A4 23
SCS 36
+5V 9
GND 33
GND 34
VCC
C1
.1uf 10 V
R1 10K
R2 10K
R3 10K
R4 10K
SW1
SW DIP-4
U4
74LS244
1Y1 1Y2 1Y3 1Y4 2Y1 2Y2 2Y3 2Y4
1A1 1A2 1A3 1A4 2A1 2A2 2A3 2A4
1G 2G
U5
74LS244
TO MORE SWITCHES
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Figure 1

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the input, it may give a reading of high or low. It all depends on exterior conditions, such as how close it is to another wire. In order to make sure the input is high, we use a resistor to tie it high. Therefore, when the switch is off, the resistor supplies +5 volts to the input of 74LS244, and the chip reads high. When the switch is on, the current is shunted to ground, and 74LS244 reads low.

The SW1 switch is only a quad switch. That means there are only four switches in that package. The 74LS244 chip has eight inputs. As you can see in Figure 1, I have connected the other four inputs to the outputs of the other chips. This is a way to monitor the output conditions of the other circuits in this project. The wiring in Figure 1 is just an example. You may not want to monitor the LEDs or motors I have selected; you can make any changes you want. For instance, you have a program that turns the first LED on and off in U1 in several places. (See Part 1 of this project for proper connections of the LEDs.) Using this read-only circuit, you are not certain at any time if the LED is on or off. Using the circuitry discussed in this column, you may now determine the condition of your LED. The same can be done with motors and buzzers.

Now that the theory is clear (I hope), let's look at the construction. You will need different parts for any application, so I'll just describe them and let you decide what you need. First, you need the board you used for the first two parts. For this application, you need one or two 74LS244 chips and one or two 20-pin sockets, depending on how many bits you need to read. For 1 to 8 bits, you need one; for 9 to 16, you need two.

Next, you'll need switches. You can use any quantity of DIP switches. The diagram shows four, but you can use any number from one to 16. You can also use individual switches and run them off the board, but the wires should be no longer than about 10 feet. In addition, don't run the wires outside. If lightning hits the switches, you'll find yourself shopping for a new computer. You'll need one resistor for every switch you use. As the diagram says, a 10K, ¼-watt resistor will do.

Bit	Decimal	Hex	Binary
D0	1	01	00000001
D1	2	02	00000010
D2	4	04	00000100
D3	8	08	00001000
D4	16	10	00010000
D5	32	20	00100000
D6	64	40	01000000
D7	128	80	10000000

Table 1: Bit Values

Mount the ICs, switches and resistors close to each other and close to the CPU's data bus. Construction is not too critical, but keep your work neat — it's better for trouble shooting. Try not to spread out your work. Next month I'll add something you might want to add as well. Check your work before turning on the computer. If something feels wrong, turn the computer off right away and check it again. Remember, my diagram does not include power and ground to the ICs; they must be connected. The two ICs you are adding this time require +5 volts at Pin 20 and ground at Pin 10. Also, use two more .1uf capacitors close to the ICs.

Finally, let's discuss the software. This project uses the CoCo's SCS pin. This maps all I/O from $FF40 to $FF5F. (Remember, the dollar sign means it's a Hex number.) To enter a Hex number on the CoCo, just put the characters &H in front of the number. Now, when you want to read the 8 bits connected to U4, the address is $FF40. The following is an example of a line in BASIC to read the 8 bits at U4:

```
100 X = PEEK(&HFF40)
```

The value returned in X is a value from zero to 255 or $FF. Each of the 8 bits contribute to the value. If the value returned is zero, then all bits on that IC (U4) are off. In order to find out which particular bit is on or off, you can use the AND command in BASIC to mask the other bits. This command will change any bit that is zero to zero. A full explanation of the AND command can be found in your BASIC manual; I will not go into detail here. I will, however, give you an example of how to do it. Look at U4 in Figure 1. I have connected Pin 13 of U4 to Pin 2 of U1. That means reading U4 and looking at D4 will give you the condition of whatever you poked at U1 D0. If U1 Pin 1 is high, then when you read U4, D4 will also be high. The following is an example of this:

```
10 POKE &HFF40,1
20 X=PEEK(&HFF40)
30 IF X AND &H8 <> 0 THEN PRINT "D4 IS
HI"
```

The first line makes D0 of U1 high; the second line reads U4; and the third line masks all bits except D4. If D4 is equal to zero, then there is something wrong. To check other bits one at a time, use the values in Table 1 with the AND command.

That's it for now. See you next time when we'll add new input devices.

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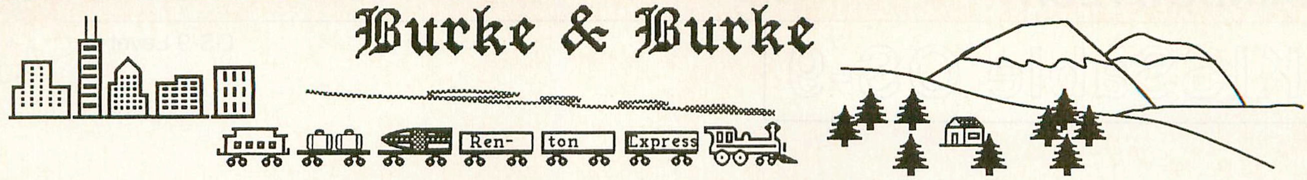

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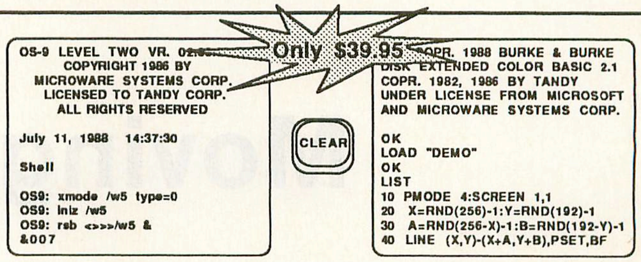

```
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July 11, 1988  14:37:30

Shell

OS9: xmode /w5 type=0
OS9: iniz /w5
OS9: rsb <>>>/w5 &
&007
```

```
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DISK EXTENDED COLOR BASIC 2.1
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UNDER LICENSE FROM MICROSOFT
AND MICROWARE SYSTEMS CORP.

OK
LOAD "DEMO"
OK
LIST
10 PMODE 4:SCREEN 1,1
20  X=RND(256)-1:Y=RND(192)-1
30  A=RND(256-X)-1:B=RND(192-Y)-1
40  LINE  (X,Y)-(X+A,Y+B),PSET,BF
```

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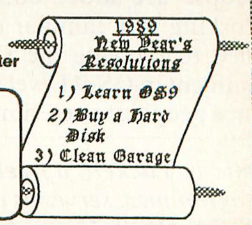

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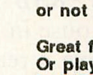
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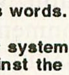

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KISSable OS-9

OS-9 Level II

Programs to tempt the DECB user

Moving to OS-9

By By Dale L. Puckett
Rainbow Contributing Editor

It's been a long wait, but we may have an easy path for Disk BASIC users who want to try OS-9. *RSB*, written by Chris Burke of Burke & Burke, modifies the code in your Color Computer's Disk BASIC ROM so it can run under OS-9. This month, let's take a look at *RSB*. Then, with the help of John Alan Lind, I'll follow Bill Barden's lead and give you another tool that makes your Color Computer an important part of amateur radio.

RSB stands for Radio Shack BASIC

I first mentioned *RSB* in this column after speaking with Chris Burke at last spring's Chicago RAINBOWfest. At the Princeton show, I had the opportunity to pick up a copy of Burke's product. *RSB* may be the incentive needed to interest more Disk BASIC users in the OS-9 operating system. If you agree, please tell your Color Computer friends about it.

Since Chris Burke believes most people are more comfortable when working in a familiar environment, he tried to recreate the Disk BASIC environment in OS-9 Level II. Chris felt that once people started running their favorite Disk Extended Color BASIC (DECB) programs on the OS-9 platform, they would begin to explore the powerful operating system. Chris feels they'll be hooked on OS-9 once they take this step and start to observe the system's power first-hand.

RSB is a version of DECB, modified to be compatible with OS-9 Level II. Because of Burke's modification, it is fully re-entrant and relocatable. At first, Color Computer BASIC users might not care that *RSB* is re-entrant and relocatable, but once they start running different BASIC programs in various OS-9 Level II windows, they'll take notice.

RSB sports a command syntax identical to that found in Disk BASIC. In addition, you'll find several new verbs that let you access OS-9 directly. *RSB* will also accept commands typed using either upper- or lowercase characters.

Burke uses OS-9 system calls for all I/O operations. With these, you can use VDG graphics screens or OS-9 Level II windows. *RSB* lets you use a Tandy Color Mouse in place of your joystick. You'll have a reason to do so — *RSB* is *Multi-Vue*-compatible. In fact, Burke ships a *Multi-Vue* `AIF` file and several icons with the program.

RSB can convert Disk Extended BASIC versions 1.0, 1.1, 2.0, 2.1 and the Disto CoCo 3 CDOS Disk BASIC to run on OS-9. There's only one catch — Burke recommends you have 512K of RAM in your Color Computer when running the program. This is a standard requirement for all OS-9 programs designed to do any real work. However, *RSB* will run in a 128K CoCo.

Installing the program is a snap. You run an install procedure supplied on the disk. After this, edit the *RSB* environment file to tell your new OS-9 BASIC interpreter about the hardware you have attached to your Color Computer. Start by making a backup of the original installation disk. Then create an OS-9 window. You can set up an OS-9 window with the following commands:

```
OS9: shell i=/w7&
&005
OS9:
```

Press CLEAR and these command lines assume the device descriptor for Window Device `/w7` is installed in your `OS9Boot` file. The process number of your new shell is 005. The shell will print it on your screen. You'll see the new screen with the word "Shell" and an OS9: prompt in the upper-left corner after you press CLEAR. Once you see the prompt, you can place your backup copy of the installation disk in Drive 0 and type the following commands:

```
chd /d0
chx /d0
install
```

You'll see a few messages, and about 10 minutes later your Color Computer will report, "Installation complete." After running the installation procedure, copy the file named `RSB` from your

---

Dale L. Puckett, a freelance writer and programmer, serves as director-at-large of the OS-9 Users Group and is a member of the Computer Press Association. His username on Delphi is DALEP: on packet-radio, KOHYD @ N4QQ; on GEnie, D.PUCKETT2; and on CIS, 71446,736.

disk in Drive 0 to the `CMDS` directory of your normal system disk. The following two commands lines will do this for you:

```
copy /d0/rsb /d1/cmds/rsb

copy /d0/sys/rsb_env.file /d1/sys/
rsb_env.file
```

After you have copied these files to your system disk you can run your new OS-9 based interpreter by entering `rsb`. This command line will give you 8K of memory for the program. The interpreter uses 3K of memory for its own variables, which leaves 5K for your BASIC program. If you are working with a longer program, you can ask OS-9 for more memory when you run *RSB* in this manner:

```
rsb #20K
```

You can also tell the program not to allocate a VDG graphics screen when it starts up. This will save 6K. If you want to run an *RSB* program from an OS-9 command line, enter a line similar to this:

```
rsb /d0/basic/mydemo #20K
```

Under *RSB*, loading a BASIC program from a disk file is just like doing so under DECB. However, with *RSB*, `Run` can unlock the universe. *RSB* lets you run OS-9 commands from within BASIC. When you get ready to return to OS-9, type `dos`.

If you move to OS-9 through *RSB*, you'll be right at home. Moving from OS-9 to DECB via *RSB*, I was occasionally at a loss for commands. (I had misplaced my DECB command summary card.) However, with a little coaxing from Burke's *RSB* manual, I was able to use the DECB syntax to open and close BASIC files. For example, the `Open` command `Open "O",1, "Saveit:3`, opens Path Number 1 to a file named `Saveit` on Drive 3. It took me a while to get used to the plot here also. Instead of typing `chd` to change my current data directory and tell OS-9 where I wanted to read or store data, I opened a drive to a directory. Look at the following example:

```
open drive 2, "/d0/games"
```

After typing this command line in *RSB*, you can load or run any program in the OS-9 directory `/d0/games` as you would with DECB. After opening the drive already described, the following command lines could be used:

```
dir 2
load "program:2"
run "demoit:2"
```

One of the big advantages of *RSB* is that it gives you a way to communicate with any device attached to your computer. The only requirement is an OS-9 device driver and descriptor. These usually come with the hardware from commercial vendors. To send output from an *RSB* program to your printer, use a sequence like this:

```
100 open "O",1,"/p"
200 print #1, "Hello, is the printer
working?"
```

Burke gives you a number of OS-9 utility commands to move your old DECB commands over to OS-9 files and *RSB*. A special command named `Skitzo` gives you a freshly formatted disk with a split personality. After you run the utility, half of the disk is recognized by OS-9, and the other half is used by Disk BASIC. `Skitzo` works with a 35-track, single-sided disk. Once you have

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made a `Skitzo` disk, you can use Burke's `HDel`, `HDir` and `HCopy` commands to move files between OS-9 and DECB.

That's it — a new toy for OS-9 hackers and a painless introduction to OS-9 for DECB programmers. Pass the word. Maybe a giant congregation of DECB programmers will join us this year.

About Those Satellites . . .

John Alan Lind (KD7XG), of Corona, California, is back this month with *TrakSat* — a BASIC09 program that tracks satellites in low-earth orbit. It's fascinating and it's fast. Lind believes *TrakSat* fills two needs: It gives him a vehicle to develop a satellite tracking program in a compiler-based language like C or Pascal; and, because *TrakSat* is written in BASIC09, a working program that everyone with OS-9 Level II can run and enjoy now can be published. If he had used Pascal, you would have to purchase OS-9 Pascal to run the program because you would need the run-time support files that come with the compiler.

TrakSat uses the general tracking strategy developed by Dr. Tom Clark (W3IWI) in his *Orbits* program. Lind has enhanced nearly all portions of the code by making use of many BASIC09 features. Lind has simplified data entry, created an improved output display, eliminated tables containing constants that expire beyond a certain date, and added the ability to make predictions in one year, based on Keplerian data from the previous year.

Lind has also made it possible to correctly compute sidereal time into the next millennium — beyond the year 2000 — and has made it easier to update the Keplerian element sets. This makes computation much faster. Lind was nice enough to let THE RAINBOW *and* me publish his copyrighted program, so you can take advantage of the educational material it contains. He has also given us permission to distribute it with RAINBOW ON DISK and on Delphi. Although *TrakSat* is a copyrighted program, Lind wants it distributed free of charge for non-commercial use in the amateur radio and OS-9 communities. Your non-profit users group may charge its members a reimbursement fee for the cost of copying the program.

To run *TrakSat*, you need to load the source code published here into BASIC09. (See Listing 1.) Then, use the BASIC09 `Pack` command to store a

```
UO-9
88
285.0977435
0
0
0
0327-10/11/88
97.6054
321.6080
0.0001255
034.4121
325.7259
15.36110723
2.5709E-04
39051
0
145.825
AO-10
88
279.1313234
0
0
0
0358-10/05/88
27.1079
301.3539
0.6034945
342.1045
003.6398
2.05880749
-8.2E-07
3996
0
145.809
UO-11
88
279.1402083
0
0
0
0352-10/05/88
98.0439
339.0661
0.0014642
044.5398
315.7023
14.62461626
+1.207E-05
24525
0
145.826
FO-12
88
279.2684671
0
0
0
0115-10/05/88
50.0147
001.9211
0.0011139
058.6669
301.5254
12.44395542
-2.5E-07
09766
0
435.0
AO-13
88
273.7266081
0
0
0
0019-09/30/88
57.5382
237.5590
0.6578369
191.3601
139.7626
2.09697959
+3.0E-07
0226
0
145.812
RS-10
88
284.8280217
0
0
0
0536-10/10/88
82.5333
062.3349
0.0012382
030.1296
330.0614
13.71910488
+1.189E-05
6520
0
29.5
RS-11
88
284.8280217
0
0
0
0536-10/10/88
82.5333
062.3349
0.0012382
030.1296
330.0614
13.71910488
+1.189E-05
6520
0
29.5
MIR
88
291.6451331
0
0
0
0460-10/17/88
51.6150
158.4827
0.0024915
202.3449
157.7286
15.74171102
3.3749E-04
15311
0
145.000
DATEND
```

Figure 1: `Satellite_dat`

packed version of *TrakSat* in your current execution directory — `/dd/cmds`. `RunB`, the BASIC09 run-time package, must also be in your current execution directory.

```
KD7XG
John
33.87
117.43
600
0
/P1
```

Figure 2: `Station_dat`

Two additional files, `Satellite_dat` and `Station_dat` must be present in your current data directory when you run *TrakSat*. (See figures 1 and 2.) `Satellite_dat` contains Keplerian element sets for many amateur radio satellites. You may edit this file to add data for additional satellites or delete data for those in which you are not interested. The format of `Satellite_dat` is specific and must remain the same; however, the number of satellites listed in the file does not matter. The last line *must* be `DATEND`. The program looks for this word and knows the end of the file has been reached when it is found. The entire format for Keplerian element sets is listed in Table 1.

Keplerian Data Sets

You will find the data you need to fill in the blanks in Table 1 in *QST* or the *Amateur Satellite Report*. It is also distributed by packet radio bulletins and ARRL RTTY bulletins. These publications provide the data in the same general order listed in Table 1. The element sets come from NASA. They should be no more than 90 days old, if accurate predictions are needed, and no more than 180 days old in most amateur radio applications. The element sets shown in Figure 1 were released during the first week of October '88.

The station data provided in Figure 2 (and defined in Table 2) is for Lind's location in Corona, California. You must use your own location to get the predictions for your location. If you are not an amateur radio operator and don't have an amateur call sign, leave the first line blank. However, *do not* delete the line because *TrakSat* expects seven lines in the `Station_dat` file.

To run *TrakSat*, you must have at

Satellite name
Epoch year
Epoch Julian date, either decimal or integer
Epoch hour if date is integer, or 0 if date is decimal
Epoch minute if date is integer, or 0 if date is decimal
Epoch second in decimal if date is integer, or 0 if date is decimal
Element set number and calendar date of element set
Inclination of orbit
RAAN: Right Ascension of the Ascending Node
Eccentricity of orbit
Argument of Perigee
Mean Anomaly
Mean Motion
Orbit Decay rate in rev/day^2
Revolution # of satellite at Epoch
Semi-major Axis of orbit, may also be 0
Beacon frequency, or mid-frequency of transponder down-link passband
DATEND

Table 1: `Satellite_dat` format

Call sign
Name
Ground Station Latitude in decimal degrees
Ground Station West Longitude in decimal degrees
Altitude above Sea Level in meters
Angle of horizon in degrees above horizontal (usually, 0)
OS-9 printer device name (usually, /P)

Table 2: `Station_dat` format

Listing 1: `TrakSat`

```
PROCEDURE traksat
 0000
 0001       (*
 0004       (* TRAKSAT - A program for computing a satellite's azimuth and
 0042       (* elevation from a specific point on the Earth's surface over
 0080       (* a specified time period.  This program is written for the
 00BC       (* Tandy Color Computer 3 under the OS-9 Level II operating
 00F7       (* system using a high resolution monitor.  The main algorithms
 0136       (* used by this program are adaptations of the algorithms used
 0174       (* by Dr. Tom Clark, W3IWI, in his noted ORBITS program.  His
 01B1       (* original program written in BASIC inspired the creation of
 01EE       (* this program for the Color Computer 3 and OS-9.  Numerous
 022A       (* improvements to the algorithms have been made to increase
 0266       (* speed and further modularize them.  The amateur satellite
 02A2       (* community owes a debt of gratitude to Dr. Clark whose
 02DA       (* original program has inspired many other orbit calculation
 0317       (* programs for various micro-computers and numerous operating
 0355       (* systems.
 0360       (*
 0363       (* Copyright (c) 1988 by:
 037C       (* John A. Lind, KD7XG
 0392       (* 2194 Conejo Street
 03A7       (* Corona, California  91720-4001
 03C8       (*
 03CB       (* Distributed as "freeware" to the amateur radio community.
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 0487       (* in the software and source code.
 04AA       (*
 04AD       (* Specific permission is granted for:
 04D3       (* 1.  Upload and distribution through commercial on-line services
 0515       (* such as CompuServe and Delphi.
 0536       (* 2.  Distribution by the OS-9 User's Group as part of their
 0573       (* library of software.
 058A       (* 3.  Distribution by the Amateur Satellite Corporation (AMSAT)
 05CA       (* any proceeds from which may be used by AMSAT for their
 0603       (* operations.
 0611       (* 4.  Publication of the source code in periodicals for the
```

least one window device available. *TrakSat* uses Window Device `/w` to open the next available window in an 80-by-24 text (Type 2) screen. When you first run the program, you will be greeted by a copyright message, and you'll hear the disk drives click while the program reads your `Station_dat` file. You will then be prompted for a start date and time. After you enter the start date, you will be asked for a duration in hours and minutes. (Lind recommends using 48 or 72 hours because this gives you several days' predictions at a time.) After you supply the duration, you will be asked for a step time in minutes. The step time is used to step the program from the start time through the chosen duration. A step time of 10 minutes is more than adequate for Phase III satellites such as AO-10 and AO-13 since these machines have orbital periods of close to half a day. If you are tracking the low-altitude Phase II satellites with orbital periods of one or two hours, you might want to use a step of one or two minutes.

TrakSat reads your `Satellite_dat` file and then asks you which satellite you would like to track. After you pick one from a menu, the program will display the orbital elements for your selection. (If you plan to ask the program to output its data to your printer, make sure you have turned your printer on and placed it online before you select the printer.) You will notice a short delay between orbit passes. BASIC09 runs *TrakSat* four to five times faster than the original DECB program, *Orbits*. Look at the source code to get an idea of the number-crunching going on in *TrakSat*.

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```
064D        (* purpose of furthering program distribution.
067B        (*
067E        (* If you like this program give it to a friend.  This program
06BC        (* may not be sold and the copyright notice must be retained in
06FB        (* the program code.  Commercial/business use of this software
0739        (* is strictly prohibited.
0753        (*
0756        (* REVISION HISTORY:
076A        (*
076D        (* Revision      Comments
0786        (* ------------------------------------------------------------
07C4        (* 1.0           Truly bare-bones "strawman" just to get things
0803        (* working!  Uses GOSUBS (yeccchh!), but gives
0831        (* results comparable to other predicion methods.
0862        (*
0865        (* 1.1           Replaced GOSUBS with separate procedures.
089F        (* Keplerian element sets and sidereal time table
08D0        (* are still embedded as DATA statements.  This
08FF        (* was OK for standard BASIC (oh what a pun!) but
0930        (* is unacceptable for BASIC09.  You can't edit
095F        (* I-code with a text editor.
097C        (*
097F        (* 1.2           Replaced sidereal time table with procedure to
09BE        (* compute it as needed for the prediction year.
09EE        (* Still need to get the Keplerian elements out of
0A20        (* the DATA statements!
0A37        (*
0A3A        (* 2.0           Not only removed the Keplerian element sets to
0A79        (* a separate text file, station data for the user
0AAB        (* is now in its own text file as well.  This
0AD8        (* eliminates the need to ask for it at the beginning
0B0D        (* of the program.  I need to revise the SKIPMUF
0B3D        (* program to read the same user station file.  The
0B70        (* file name is different and this one has an extra
0BA3        (* line in it for horizon data.
0BC2        (*
0BC5        (* 2.1           Fixed a minor bug in paginating the print-out portion
0C0B        (* of the code.  Fixed the sidereal procedure to compute
0C43        (* correctly into the next millenium.  Users would have
0C7A        (* had an interesting surprise using a sidereal time con-
0CB3        (* stant for 1900 in the year 2000!
0CD6        (*
0CD9        (* 2.2           Added code to allow computation of orbits using
0D19        (* element sets from the previous year.  This solves
0D4D        (* the Jan/Feb agony every year.  Also added code to
0D81        (* display and print the calendar date instead of the
0DB6        (* Julian date in the output.  This was definitely not
0DEC        (* easy, epecially when combined with having to be able
0E23        (* to use the previous year's element sets.  I never
0E57        (* did like the Julian date in the output, though.  Most
0E8F        (* of us are used to thinking in calendar dates and Julian
0EC9        (* dates are too confusing, especially in leap years.
0EFE        (* It makes more sense to let the computer worry about
0F34        (* what day it really is and do all the conversion work.
0F6C        (* I may just burn my Julian date cheat sheet now.
0F9E        (*
0FA1        (* 2.3           Fixed the problem of the doppler shift being wacko on
0FE7        (* the first line of output.  It was an easy fix and has
101F        (* bugged me for some time.  I don't know why I didn't do
1058        (* it before now.  Also tidied up some of the output in
108F        (* the portions of code that interact with the user to
10C5        (* request data.
10D5        (*
10D8        (* 2.4           Decided to have program open its own 80x24 text screen.
1120        (* Sooner or later someone would try to run it on a 40x24
1159        (* graphics screen or some other bizzare combination and
1191        (* get strange results.  Now opens a white on blue stan-
11C9        (* dard screen and resets the palette registers to the
11FF        (* default.  Discovered in the process that the MultiView
1238        (* gshell does strange things to the palette registers when
1273        (* it reads the "stock" env.file during initialization.
12AA        (* Had to rewrite the env.file for MultiView to set the
12E1        (* palette to its standard colors.  Whoever set the palette
131C        (* up in the "stock" env.file must have strange taste in
1354        (* colors - either that or I have strange tastes.  This
138B        (* looks like it will be the last rev in BASIC09.  Unless
13C4        (* I discover a serious bug, anything else that comes to
13FC        (* mind will have to wait until I rewrite it in OS-9
1430        (* Pascal or C.
143F        (*
1442        DIM ABORT,FLAG1,FLAG2,FLAG3,PV,FIRSTRUN:BOOLEAN
145D        DIM GG,I,J,LN,PG,PRN,SCRN:INTEGER
147C        DIM A,A0,A9,CC,C(3,2),C8,C9,D,D3,D9,DC,DD,E,E0,E1,E8,F,F1:REAL
14D0        DIM F9,G0,G1,G2,H,H1,H3,H4,H9,I0,JULCAL(13),K,K0,K7,L5,L9:REAL
1518        DIM M,M0,M1,M2,M3,M4,N,N0,N1,O,O0,P0,Q0,R,R0,R5,R6,R8,S3,S4

             :REAL
156B        DIM S8,S9,T,T0,T1,T2,T3,T6,T7,T8,T9,W,W0,W5,W9,X,X9,Y,Y3,Y9

             ,Z,Z9:REAL
15C6        DIM DASTART,MOSTART,YRSTART:REAL
15D5        DIM DANOW,MONOW,YRNOW:REAL
15E4        DIM AA$:STRING[1]
15F0        DIM C$:STRING[6]
15FC        DIM DATEN$:STRING[8]
```

```
1608      DIM DATORB1$:STRING[52]
1614      DIM DATORB2$:STRING[11]
1620      DIM DD$:STRING[12]
162C      DIM DNOW$:STRING[2]
1638      DIM H$:STRING[2]
1644      DIM H4$:STRING[2]
1650      DIM I$:STRING[40]
165C      DIM MNOW$:STRING[2]
1668      DIM M4$:STRING[2]
1674      DIM N$:STRING[20]
1680      DIM PRNPATH:STRING[32]
168C      DIM S$:STRING[40]
1698      DIM S4$:STRING[2]
16A4      DIM TNOW$:STRING[7]
16B0      DIM WNDW$:STRING[2]
16BC      DIM YNOW$:STRING[2]
16C8
16C9      FOR I:=1 TO 13
16D9        READ JULCAL(I)
16E2      NEXT I
16ED      R8:=.0
16F8      T6:=.0
1703      CC:=299792.5
170E      R0:=6378.16
1719      F:=1./298.25
172B      G0:=7.5369793E+13
1736      G1:=1.00273791
1741      P0:=PI/180.
174E      DATORB1$:="T9,'----------- DATE: ',S8,' -------- ORBIT #',R7.0>"
1789      DATORB2$:="-----------"
179B      WNDW$:="/W"
17A4
17A5      SCRN:=0
17AC      OPEN #SCRN,WNDW$:UPDATE
17B8      PRINT #SCRN,CHR$($1B); CHR$($20); CHR$(2); CHR$(0); CHR$(0)

            ;
17D5      PRINT #SCRN,CHR$(80); CHR$(24); CHR$(0); CHR$(1); CHR$(1);
17F0      PRINT #SCRN,CHR$($1B); CHR$($30);
1801      PRINT #SCRN,CHR$($1B); CHR$($21);
1812
1813      RUN LOGO(SCRN)
181D
181E      RUN INIT1(C$,N$,L9,W9,H9,E8,PRNPATH)
1846
```

If you get hooked on satellite tracking after running *TrakSat*, Lind says *The Satellite Experimenter's Handbook* is the best beginner's book on the subject. If you really love the subject, he recommends the current *Astronomical Almanac* from the U.S. Government Printing Office and *Fundamentals of Astrodynamics*, published by Dover.

If you are an active ham, you can send a message to Lind's packet bulletin board. His address is KD7XG @ KD7XG. Lind runs the following packet bulletin boards: KD7XG-0, a packet gateway for Southern California operating in the 20-meter (14-Meg) amateur radio band; KD7XG-1, a packet bulletin board system on 145.05 Meg; and KD7XG-2, a packet bulletin board system on 223.42 Meg.

A few nights on packet radio will make you a believer. I recently received a message at my home bulletin board (K0HYD @ N4QQ) containing a request for a portion of some C source code accidentally deleted from "KISSable OS-9" last spring. I found the code and sent it back up to Bob (KC2WZ @ NN2Z) in New York. The next day, I got a message saying he had received the source code and all was working well.

I hope by the time you read this the manufacturer of my packet radio termi-

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nal node controller will have upgraded my firmware and I will have a personal mailbox running 24 hours a day. (I'll give you the details when I get the firmware.) However, if you want to get a head start and would like to chat live via packet radio, try to connect with KOHYD via DCA4 — one of the NetROM nodes run by K3AF in Washington, D.C.

A Modified Echo from Goldberg

I received a note and another contribution from Steve Goldberg in Bethpage, New York. I can't say enough about Goldberg's utilities. I have them all loaded on my hard drive and use them quite often. Steve has made a fantastic contribution to the OS-9 community.

This month THE RAINBOW and I are publishing an enhanced version of the `Echo` command that delivers some of the features found in the UNIX version. The new features are as follows:

`\n`	Go to a new line
`\c`	Terminate display without a new line
`\f`	Clear the screen (form feed)
`\\`	Print a backslash (\)
`\###`	Print the character with an ASCII value of ###

The following is a sample command line:

```
echo \f\7Now is the time\nfor all
good men\nto come to the aid\nof
their party.\n\nThe date and time
are: \c;date t
```

If you enter the preceding example, `Echo` will clear your screen, sound your Color Computer bell and display the following message on the screen:

Now is the time
for all good men
to come to the aid
of their party.
The date and time are:
December 14, 1988 21:30:25

Kenneth-Leigh Enterprises is run by author Paul Ward, who tells me his second edition of *Start OS-9* should be out by the time you read this. He has designed this edition to fit better on your desk and be easier to use. Give it a try.

That's about all for March. If I find the time, I plan to develop a `FindFile` utility for OS-9 Level II. (I better find time, I need the utility.) Till then, keep on hacking! ☐

```
1847    REPEAT
1849      REPEAT
184B        REPEAT
184D
184E          PG:=0
1855          LN:=0
185C
185D          PRINT #SCRN,CHR$(12);
1868          PRINT #SCRN,TAB(26); "KD7XG Orbit Prediction Program"
1893          PRINT #SCRN,
189A          PRINT #SCRN,
18A1
18A2          PRINT #SCRN,TAB(25);
18AD          PRINT #SCRN,"Input data for initialization:"
18D4          PRINT #SCRN,TAB(25);
18DF          INPUT #SCRN," Start:   Year = ",YRSTART
18FD          YRSTART:=INT(100.*(YRSTART/100.-INT(YRSTART/100.))+.1

               )
1927          FLAG1:=YRSTART/4.=INT(YRSTART/4.)
1942          FLAG3:=FLAG1
194A          YRNOW:=YRSTART
1952          RUN STRNGNUM(YNOW$,YRNOW)
1961
1962          REPEAT
1964            PRINT #SCRN,TAB(25);
196F            INPUT #SCRN,"          Month = ",MOSTART
198D          UNTIL MOSTART>=1. AND MOSTART<=12.
19A7          MONOW:=MOSTART
19AF          RUN STRNGNUM(MNOW$,MONOW)
19BE
19BF          REPEAT
19C1            PRINT #SCRN,TAB(25);
19CC            INPUT #SCRN,"          Day = ",DASTART
19EA          UNTIL DASTART>=1. AND DASTART<=31.
1A04          DANOW:=DASTART
1A0C          RUN STRNGNUM(DNOW$,DANOW)
1A1B
1A1C          DATEN$:=MNOW$+"/"+DNOW$+"/"+YNOW$
1A34
1A35          T1:=DASTART+JULCAL(FIX(MOSTART))
1A45          IF FLAG1 AND MOSTART>2. THEN
1A59            T1:=T1+1.
1A68          ENDIF
1A6A
1A6B          REPEAT
1A6D            PRINT #SCRN,TAB(25);
1A78            INPUT #SCRN," Start:  Hours = ",H
1A96          UNTIL H>=.0 AND H<=24.
1AB0
1AB1          REPEAT
1AB3            PRINT #SCRN,TAB(25);
1ABE            INPUT #SCRN,"         Minutes = ",M
1ADC          UNTIL M>=.0 AND M<=59.
1AF6          T1:=T1+H/24.+M/1440.
1B14
1B15          REPEAT
1B17            PRINT #SCRN,TAB(25);
1B22            INPUT #SCRN," Duration: Hours = ",H1
1B42          UNTIL H1>=.0
1B51          REPEAT
1B53            PRINT #SCRN,TAB(25);
1B5E            INPUT #SCRN,"         Minutes = ",M1
1B7E          UNTIL M1>=.0 AND M1<=59.
1B98          T2:=T1+H1/24.+M1/1440.
1BB6
1BB7          REPEAT
1BB9            PRINT #SCRN,TAB(25);
1BC4            INPUT #SCRN," Step:   Minutes = ",M2
1BE4          UNTIL M2>.0 AND M2<=60.
1BFE          T9:=M2/1440.
1C0D
1C0E          PRINT #SCRN,TAB(25);
1C19          INPUT #SCRN,"Is above data correct? ",AA$
1C3D         UNTIL AA$<>"N" AND AA$<>"n"
1C51
1C52         PRINT #SCRN,TAB(25);
1C5D         PRINT #SCRN USING "X5,'Start time = ',R9.4>",T1
1C82         PRINT #SCRN,TAB(25);
1C8D         PRINT #SCRN USING "X6,'Stop time = ',R9.4>",T2
1CB1         PRINT #SCRN,TAB(25);
1CBC         INPUT #SCRN,"To continue press ENTER ",AA$
1CE1
1CE2         RUN GEOCENTR(C8,C9,F,H9,L9,P0,R0,S8,S9,W9,X9,Y9,Z9)
1D28
1D29         PRINT #SCRN,CHR$(12);
1D34         PRINT #SCRN,TAB(34); "STATION: "; C$
1D4E         PRINT #SCRN USING "T29,'LAT: ',R6.2>,' LONG: ',R7.2>",L9

              ,W9
1D80         PRINT #SCRN USING "T26,'ELEV:',R6.0>,'  MIN HORIZON:',R5.1>"

              ,H9,E8
1DB9         PRINT #SCRN,
1DC0
1DC1         RUN GETDAT(SCRN,S$,I$,Y3,D3,H3,M3,S3,I0,O0,E0,W0,M0,N0,
              N1,K0,A0,F1)
1E20
1E21          FLAG2:=Y3/4.=INT(Y3/4.)
1E3C
1E3D          ABORT:=FALSE
1E43          IF Y3<>YRSTART THEN
1E50            IF Y3=YRSTART-1 OR YRSTART=0 AND Y3=99 THEN
1E71              IF FLAG2 THEN
1E7A                T7:=T1+366.
1E89                T8:=T2+366.
1E98              ELSE
1E9C                T7:=T1+365.
1EAB                T8:=T2+365.
1EBA              ENDIF
1EBC              RUN SIDEREAL(Y3,G2)
1ECB            ELSE
1ECF              PRINT #SCRN,CHR$(12);
1EDA              FOR I:=1 TO 7
1EEA                PRINT #SCRN,
1EF1              NEXT I
1EFC              PRINT #SCRN,TAB(14); "This satellite's element set is OVER A YEAR OLD!!"
1F3A              PRINT #SCRN,TAB(19); "Update element set for this satellite."
1F6D              PRINT #SCRN,TAB(27); CHR$($1F); CHR$($24); "Aborting this run!"

                   ; CHR$($1F); CHR$($25)
1FA0              ABORT:=TRUE
1FA6              PRINT #SCRN,
1FAD              REPEAT
1FAF                PRINT #SCRN,TAB(20); "Do you want to quit now (Y/N)"

                     ;
1FDA                INPUT #SCRN,AA$
1FE4              UNTIL AA$="y" OR AA$="n" OR AA$="Y" OR AA$="N"
2008              IF AA$="y" OR AA$="Y" THEN
201D                CLOSE #SCRN
2023                END "TRAKSAT aborted"
2036              ENDIF
2038            ENDIF
203A          ELSE
203E            T7:=T1
2046            T8:=T2
204E            RUN SIDEREAL(Y3,G2)
205D          ENDIF
205F        UNTIL NOT(ABORT)
2068
2069        PRINT #SCRN,CHR$(12);
2074        REPEAT
2076          FOR I:=1 TO 7
2086            PRINT #SCRN,
208D          NEXT I
2098          PRINT #SCRN,TAB(18);
20A3          INPUT #SCRN,"Output to printer or screen (enter P or S)? "

               ,AA$
20DC        UNTIL AA$="P" OR AA$="p" OR AA$="S" OR AA$="s"
2100        IF AA$="P" OR AA$="p" THEN
2115          PV:=TRUE
211B          PRINT #SCRN,
2122          PRINT #SCRN,TAB(22); CHR$($1F); CHR$($24);
2137          PRINT #SCRN,"Make sure printer is on and ready!"; CHR$(

               $1F); CHR$($25)
216C          PRINT #SCRN,
2173          PRINT #SCRN,TAB(27);
217E          INPUT #SCRN,"Press ENTER to continue",AA$
21A2          PRN:=0
21A9          OPEN #PRN,PRNPATH:UPDATE
21B5        ELSE
21B9          PV:=FALSE
21BF        ENDIF
21C1
21C2        IF D3=INT(D3) THEN
21D0          T0:=D3+H3/24.+M3/1440.+S3/86400.
21F9        ELSE
21FD          T0:=D3
2205        ENDIF
2207
2208        T:=T7-T9
2214        RUN ELEMUPDT(A,A0,C,E0,E1,G0,I0,K0,M0,N,N0,N1,O,O0,P0,Q0,

             R0,T,T0,W,W0)
2282        RUN MEANANOM(K,M,M9,N0,N1,Q,Q0,T,T0)
22B4        RUN TRUEANOM(A0,C,E0,E1,G1,G2,M,R,T,X,Y,Z)
22F5        RUN AZELRNGE(A9,C8,C9,E9.L5,P0,R,R5,R6,R8,S8,S9,T,T6,W5,X
             ,X9,Y,Y9,Z,Z9)
2363        T:=T7
236B        RUN ELEMUPDT(A,A0,C,E0,E1,G0,I0,K0,M0,N,N0,N1,O,O0,P0,Q0,

             R0,T,T0,W,W0)
23D9        RUN MEANANOM(K,M,M9,N0,N1,Q,Q0,T,T0)
240B        PRINT #SCRN,CHR$(12);
2416        PRINT #SCRN,TAB(14); "Elements for: "; S$
2435        PRINT #SCRN,TAB(13); "Element set: "; I$
2453        PRINT #SCRN,TAB(13); "======================================================"
2494        PRINT #SCRN,TAB(13); "Element             Reference          Starting"
24CF        PRINT #SCRN,TAB(13); "------------------------------------------------------"
```

Submitting Material To Rainbow

Contributions to THE RAINBOW are welcome from everyone. We like to run a variety of programs that are useful/helpful/fun for other CoCo owners.

WHAT TO WRITE: We are interested in what you may wish to tell our readers. We accept for consideration anything that is well-written and has a practical application for the Tandy Color Computer. If it interests you, it will probably interest lots of others. However, we vastly prefer articles with accompanying programs which can be entered and run. The more unique the idea, the more the appeal. We have a continuing need for short articles with short listings. These are especially appealing to our many beginners.

FORMAT: Program submissions must be on tape or disk, and it is best to make several saves, at least one of them in ASCII format. We're sorry, but we do not have time to key in programs and debug our typing errors. All programs should be supported by some editorial commentary explaining how the program works. We also prefer that editorial copy be included on the tape or disk using any of the word processors currently available for the Color Computer. Also, please include a double-spaced printout of your editorial material and program listing. Do not send text in all capital letters; use upper- and lowercase.

COMPENSATION: We do pay for submissions, based on a number of criteria. Those wishing remuneration should *so state* when making submissions.

For the benefit of those who wish more detailed information on making submissions, please send a self-addressed, stamped envelope (SASE) to: Submission Guidelines, THE RAINBOW, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. We will send you comprehensive guidelines.

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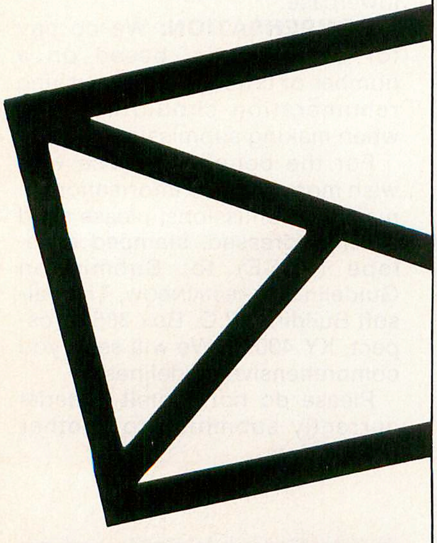

```
2510        PRINT #SCRN,TAB(13); "Epoch"; TAB(34); Y3; "+"; T0; TAB(52

             ); YRSTART; "+"; T1
2542        PRINT #SCRN,TAB(13); "Incl of Orbit"; TAB(34); I0; TAB(52

             ); I0
256C        PRINT #SCRN,TAB(13); "RAAN"; TAB(34); O0; TAB(52); O
258D        PRINT #SCRN,TAB(13); "Eccentricity"; TAB(34); E0; TAB(52)

             ; E0
25B6        PRINT #SCRN,TAB(13); "Arg of Perigee"; TAB(34); W0; TAB(52

             ); W
25E1        PRINT #SCRN,TAB(13); "Mean Anomaly"; TAB(34); M0; TAB(52)

             ; M/P0
260E        PRINT #SCRN,TAB(13); "Mean Motion"; TAB(34); N0; TAB(52); N0
2636        PRINT #SCRN,TAB(13); "Decay Rate"; TAB(34); N1; TAB(52); N1
265D        PRINT #SCRN,TAB(13); "Ref Orbit #"; TAB(34); K0; TAB(52); K
2685        PRINT #SCRN,TAB(13); "Semi-Maj Axis"; TAB(34); A0; TAB(52

             ); A0
26AF        PRINT #SCRN,TAB(13); "Beacon Freq"; TAB(34); F1; TAB(52); F1
26D7        PRINT #SCRN,
26DE        IF T7-T0<=90. THEN
26F2          PRINT #SCRN,TAB(13); "Element set is "; FIX(T7-T0); " days old."
2724          PRINT #SCRN,
272B        ELSE
272F          IF T7-T0<=180. THEN
2743            PRINT #SCRN,TAB(13); "Element set is "; CHR$($1F); CHR$

                 ($24); FIX(T7-T0);
2773            PRINT #SCRN,CHR$($1F); CHR$($25); " days old."
2790            PRINT #SCRN,
2797          ELSE
279B            PRINT #SCRN,TAB(13); CHR$($1F); CHR$($24);
27B0            PRINT #SCRN,"WARNING: Element set is "; FIX(T7-T0); " days old."

                 ;
27E8            PRINT #SCRN,CHR$($1F); CHR$($25)
27F8            PRINT #SCRN,
27FF          ENDIF
2801        ENDIF
2803        PRINT #SCRN,TAB(13);
280E        INPUT #SCRN,"Press ENTER to start ",AA$
2830        PRINT #SCRN,
2837        PRINT #SCRN,CHR$($1F); CHR$($24);
2848        PRINT #SCRN,TAB(13); "Performing calculations ..."
2870        PRINT #SCRN,CHR$($1F); CHR$($25);
2881
2882        K9:=9.0E+09
288D        K8:=9.0E+09
2898        D0:=2.
28A3        FIRSTRUN:=TRUE
28A9        PG:=1
28B0        LN:=0
28B7        T3:=T1
28BF        FOR T:=T7 TO T8 STEP T9
28D7
28D8          IF K7<>INT(T3) THEN
28E6            IF T3>=366. AND NOT(FLAG3) OR T3>=367. THEN
2906              IF FLAG3 THEN
290F                T3:=T3-366.
291E              ELSE
2922                T3:=T3-365.
2931              ENDIF
2933              IF YRNOW=99. THEN
2943                YRNOW:=.0
294E              ELSE
2952                YRNOW:=YRNOW+1.
2961              ENDIF
2963              FLAG3:=YRNOW/4.=INT(YRNOW/4.)
297E              RUN STRNGNUM(YNOW$,YRNOW)
298D            ENDIF
298F            I:=0
2996            DANOW:=INT(T3)
299F            REPEAT
29A1              I:=I+1
29AC              IF FLAG3 AND I=2 THEN
29BC                DANOW:=DANOW-1.
29CB              ENDIF
29CD            UNTIL JULCAL(I+1)>=DANOW
29DF            MONOW:=FLOAT(I)
29E8            DANOW:=DANOW-JULCAL(I)
29F7            IF FLAG3 AND I=2 THEN
2A07              DANOW:=DANOW+1.
2A16            ENDIF
2A18            RUN STRNGNUM(MNOW$,MONOW)
2A27            RUN STRNGNUM(DNOW$,DANOW)
2A36            DATEN$:=MNOW$+"/"+DNOW$+"/"+YNOW$
2A4E            K7:=INT(T3)
2A57          ENDIF
2A59
2A5A          RUN MEANANOM(K,M,M9,N0,N1,Q,Q0,T,T0)
2A8C          IF D0=0 AND K<>K9 THEN
2AA1            RUN ELEMUPDT(A,A0,C,E0,E1,G0,I0,K0,M0,N,N0,N1,O,O0,P0
                ,Q0,R0,T,T0,W,W0)
 2B0F         K8:=9.0E+09
 2B1A         K9:=9.0E+09
 2B25       ENDIF
 2B27       RUN TRUEANOM(A0,C,E0,E1,G1,G2,M,R,T,X,Y,Z)
 2B68       RUN AZELRNGE(A9,C8,C9,E9,L5,P0,R,R5,R6,R8,S8,S9,T,T6,W5

             ,X,X9,Y,Y9,Z,Z9)
 2BD6       D:=E9-E8
 2BE2       IF D<.0 THEN
 2BF2         IF D0<>1 THEN
2BFF            D:=R5*D*D*.000000001
2C16            D0:=0
2C1E            IF D>.2/N0 THEN
2C32              T:=T+.2/N0
2C45              T3:=T3+.2/N0
2C58            ELSE
2C5C              T:=T+D
2C68              T3:=T3+D
2C74            ENDIF
2C76          ENDIF
2C78        ELSE
2C7C          IF D0=0 THEN
2C89            IF T3>=T1 THEN
2C96              T3:=T1+T9*INT((T-T7)/T9-2.)
2CB6            ELSE
2CBA              IF FLAG1 THEN
2CC3                T3:=T1+T9*INT((T-T7)/T9-2.)-366.
2CEA              ELSE
2CEE                T3:=T1+T9*INT((T-T7)/T9-2.)-365.
2D15              ENDIF
2D17            ENDIF
2D19            T:=T7+T9*INT((T-T7)/T9-2.)
2D39            D0:=1
2D41          ELSE
2D45            D0:=2
2D4D            IF K7<>K8 OR K<>K9 THEN
2D62              IF K<>K9 AND FIRSTRUN THEN
2D73                K9:=K
2D7B                RUN SCRNHDR(SCRN,C$,DATEN$,DATORB1$,DATORB2$,S$

                     ,GG,LN,K)
2DAD                IF PV THEN
2DB6                  RUN PRNTRHDR(PRN,LN,PG,E8,F1,H9,K,L9,W9,C$,DATEN$

                       ,DATORB1$,DATORB2$,S$)
2E01                ENDIF
2E03                FIRSTRUN:=FALSE
2E09              ELSE
2E0D                IF K<>K9 THEN
2E1A                  K9:=K
2E22                ENDIF
2E24                PRINT #SCRN USING DATORB1$,DATEN$,K;
2E37                PRINT #SCRN,DATORB2$
2E41                GG:=GG+1
2E4C                IF GG=23 THEN
2E58                  RUN SCRNCONT(SCRN,PV)
2E67                  RUN SCRNHDR(SCRN,C$,DATEN$,DATORB1$,DATORB2$,

                       S$,GG,LN,K)
2E99                ENDIF
2E9B                IF PV THEN
2EA4                  IF LN>=59 THEN
2EB0                    PRINT #PRN,
2EB7                    LN:=0
2EBE                    PG:=PG+1
2EC9                    RUN PRNTRHDR(PRN,LN,PG,E8,F1,H9,K,L9,W9,C$,

                         DATEN$,DATORB1$,DATORB2$,S$)
2F14                  ELSE
2F18                    PRINT #PRN USING DATORB1$,DATEN$,K;
2F2B                    PRINT #PRN,DATORB2$
2F35                    LN:=LN+1
2F40                  ENDIF
2F42                ENDIF
2F44              ENDIF
2F46            ENDIF
2F48
2F49            K8:=K7
2F51            T4:=T-INT(T)
2F5E            S4:=INT(T4*86400.+.5)
2F75            H4:=INT(S4/3600.+.000001)
2F8C            M4:=INT((S4-H4*3600.)/60.+.000001)
2FAE            S4:=S4-3600.*H4-60.*M4
2FCC            F9:=-(F1)*1000000.*R8/CC
2FE4            RUN STRNGNUM(H4$,H4)
2FF3            RUN STRNGNUM(M4$,M4)
3002            RUN STRNGNUM(S4$,S4)
3011            TNOW$:=H4$+M4$+":"+S4$
3025
3026            PRINT #SCRN USING "T8,S7>,T17,R5.0>,T24,R4.0>,T28,R7.0>,T37,R7.0>"

             ,TNOW$,A9,E9,F9,R5;
3072            PRINT #SCRN USING "T44,R7.0>,T52,R4.0>,T58,R5.0>,T67,R5.0>"

             ,R-R0,L5,W5,M9
```

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About The One-Liner Contest . . .

THE RAINBOW's One-Liner Contest has now been expanded to include programs of either one or two lines. This means a new dimension and new opportunity for those who have "really neat" programs that simply just won't fit in one line.

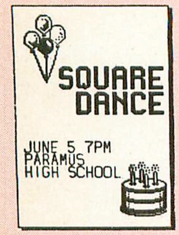
Here are the guidelines: The program must work in Extended BASIC, have only one or two line numbers and be entirely self-contained — no loading other programs, no calling ROM routines, no poked-in machine language code. The program has to run when typed in directly (since that's how our readers will use it). Make sure your line, or lines, aren't packed so tightly that the program won't list completely. Finally, any instructions needed should be *very* short.

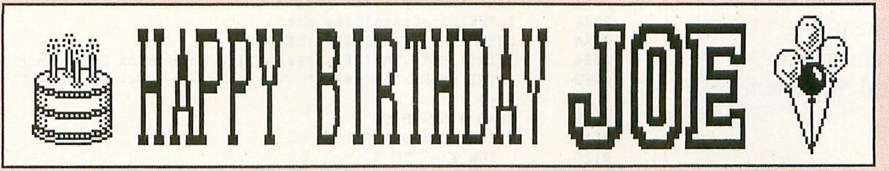
Send your entry (preferably on cassette or disk) to:

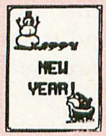
THE RAINBOW
One-Liner Contest
P.O. Box 385
Prospect, KY 40059

```
 30B6             GG:=GG+1
 30C1             IF GG=23 THEN
 30CD               RUN SCRNCONT(SCRN,PV)
 30DC               RUN SCRNHDR(SCRN,C$,DATEN$,DATORB1$,DATORB2$,S$,GG

                     ,LN,K)
 310E             ENDIF
 3110
 3111             IF PV THEN
 311A               PRINT #PRN USING "T8,S7>,T17,R5.0>,T24,R4.0>,T28,R7.0>,T37,R7.0>"

                     ,TNOW$,A9,E9,F9,R5;
 3166               PRINT #PRN USING "T44,R7.0>,T52,R4.0>,T58,R5.0>,T67,R5.0>"

                     ,R-R0,L5,W5,M9
 31AA               LN:=LN+1
 31B5               IF LN>=60 THEN
 31C1                 LN:=0
 31C8                 PG:=PG+1
 31D3                 RUN PRNTRHDR(PRN,LN,PG,E8,F1,H9,K,L9,W9,C$,DATEN$

                       ,DATORB1$,DATORB2$,S$)
 321E               ENDIF
 3220             ENDIF
 3222
 3223           ENDIF
 3225         ENDIF
 3227         T3:=T3+T9
 3233       NEXT T
 323E
 323F       PRINT #SCRN,"End of "; S$; " calculations.  ";
 3267       IF PV AND LN<61 THEN
 3277         REPEAT
 3279           PRINT #PRN,
 3280           LN:=LN+1
 328B         UNTIL LN>=63
 3296       ENDIF
 3298       PRINT #SCRN,"Enter Q to quit, any other key to continue. "

             ;
 32CE       INPUT #SCRN,AA$
 32D8     UNTIL AA$="q" OR AA$="Q"
 32EC
 32ED     IF PV THEN
 32F6       CLOSE #PRN
 32FC     ENDIF
 32FE     CLOSE #SCRN
 3304     END
 3306
 3307     DATA .0,31.,59.,90.,120.,151.,181.,212.,243.,273.,304.,334.

           ,365.
 3366     END
 3368
PROCEDURE logo
 0000
 0001     PARAM SCRN:INTEGER
 0008     PRINT #SCRN,CHR$(12);
 0013     FOR I:=1 TO 5
 0025       PRINT #SCRN,
 002C     NEXT I
 0037     PRINT #SCRN,TAB(33); "TRAKSAT  v 2.4"
 0052     PRINT #SCRN,TAB(28); "Orbit Prediction Program"
 0077     PRINT #SCRN,
 007E     PRINT #SCRN,TAB(29); "Copyright (c) 1988  by"
 00A1     PRINT #SCRN,TAB(30); "John A. Lind,  KD7XG"
 00C2     PRINT #SCRN,TAB(31); "Corona, California"
 00E1     FOR I:=1 TO 16000
 00F4     NEXT I
 00FF     PRINT #SCRN,CHR$(12);
 010A     END
 010C
PROCEDURE initl
 0000
 0001     PARAM C$:STRING[6]; N$:STRING[20]; L9,W9,H9,E8:REAL; PRNPATH

            :STRING[32]
 0035     DIM INPATH:BYTE
 003C     OPEN #INPATH,"station_dat":READ
 0052     READ #INPATH,C$
 005C     READ #INPATH,N$
 0066     READ #INPATH,L9
 0070     READ #INPATH,W9
 007A     READ #INPATH,H9
 0084     READ #INPATH,E8
 008E     READ #INPATH,PRNPATH
 0098     CLOSE #INPATH
 009E     END
 00A0
PROCEDURE getdat
 0000
 0001     PARAM SCRN:INTEGER; S$,I$:STRING[40]; Y3,D3,H3,M3,S3,I0,O0,

            E0,W0,M0,N0,N1,K0,A0,F1:REAL
 0055     DIM INPATH:BYTE
```

The Coco Graphics Designer Plus $29.95

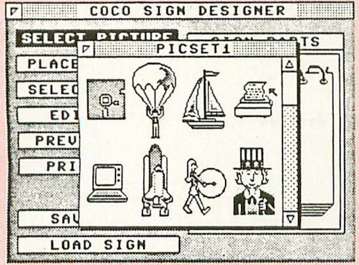

SQUARE DANCE
JUNE 5 7PM
PARAMUS
HIGH SCHOOL


HAPPY BIRTHDAY JOE


HAPPY
NEW
YEAR!

Makes Signs, Banners, Greeting Cards

Super easy-to-use point and click graphical interface, features windows, scroll bars, radio buttons, and joystick or mouse control.


COCO SIGN DESIGNER
SELECT PICTURE
PLACE
SELEC
EDI
PREV
PRI
SAV
LOAD SIGN
PICSET1
TS

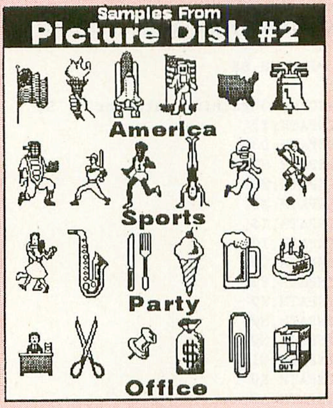
The CoCo Graphics Designer Plus (CGDP) is CoCo 2 and 3 Compatible. It allows pictures, and text in up to 4 sizes and 16 fonts, per page or banner. The cards & signs feature hi-resolution borders and complete on-screen previews. The CGDP comes with 16 borders, 5 fonts, and 32 pictures. It's 100% machine language for fast execution.

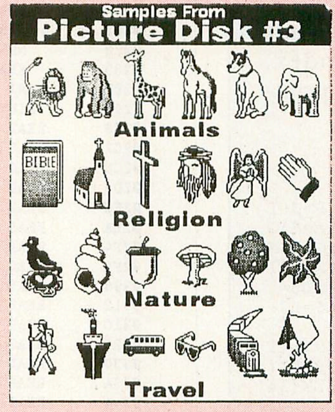
Printer Support Radio Shack DMP105, 106, 110,120, 130, 132, 200, 400, 420, 430, 440, 500, Epson FX/RX/LX/EX, LQ, Star 10X, SG10, NX10, NX1000, Panasonic KXP1080, 1090, 1091, 1092, Prowriter, C. Itoh 8510 & more.. Call for complete list.

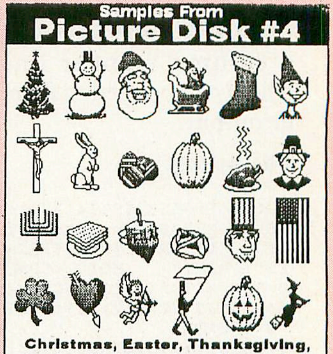
Requirements: 64K CoCo II or III, disk drive with RSDOS, mouse or joystick.

Picture Disks Now
CoCo MAX
& MAX-10
Compatible

In response to the many requests we received, our picture disks now include a simple format conversion utility making them easy to use with Colorware's MAX-10 and CoCo MAX II and III.

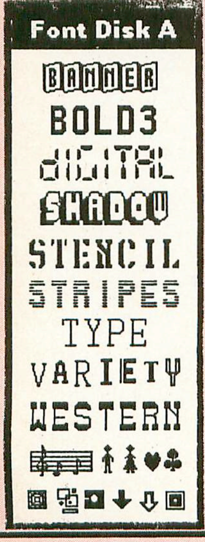

Samples From
Picture Disk #2
America
Sports
Party
Office

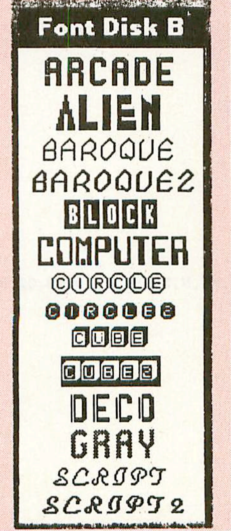

Samples From
Picture Disk #3
Animals
BIBLE
Religion
Nature
Travel


Samples From
Picture Disk #4

Christmas, Easter, Thanksgiving, Jewish Holidays, New Years, July 4th, Halloween, Parades, Saint Patrick's, Saint Valentines Day

These two optional font collections supplement the fonts built into the CGDP.
Font Disk A 10 fonts $14.95
Font Disk B 10 fonts $14.95


Font Disk A
BANNER
BOLD3
DIGITAL
SHADOW
STENCIL
STRIPES
TYPE
VARIETY
WESTERN

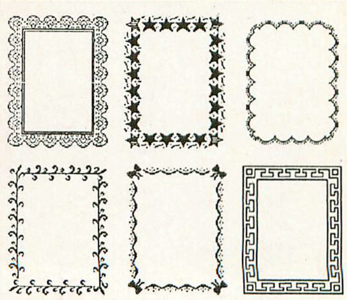

Font Disk B
ARCADE
ALIEN
BAROQUE
BAROQUE2
BLOCK
COMPUTER
CIRCLE
CIRCLES
CUBE
CUBES
DECO
GRAY
SCRIPT
SCRIPT2

GREAT COCO CLIP-ART! Picture disks 2, 3, and 4, supplement the pictures that come with the CGDP. Each disk has 120 pictures arranged by subject. A few samples are shown above. Besides being compatible with Zebra's CGD and CGDP, each disk contains a utility to easily transform our pictures into CoCo Max pages, CoCo Max II clip book pages, CoCo Max III scrap books, and Max-10 clip art files. Order your picture disks today and use our great clip art with your favorite graphics programs!

Zebra's Picture disks 2, 3, and 4 are priced at $14.95 each.

New Product!
Border Disk #1

Over 100 high-resolution borders for the CoCo Graphics Designer Plus. Includes geometric patterns and artistic graphics for making great signs and greeting cards. A few samples are shown here at the right. Order CGDP Borber Disk#1 **$14.95**



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Zebra Systems, Inc., 78-06 Jamaica Ave., Woodhaven, NY 11421 (718) 296-2385

One-Liner Contest Winner . . .

This CoCo 3 one-liner illustrates the use of the PALETTE command to create animation — experience the "Sound Stretcher."

The listing:

```
0 RGB:A=160:B=A:M=96:HSCREEN2:FO
RZ=1TO8:C=C+Z:PALETTE0,0:FORL=1T
O15:D=L:A=A-1:HCIRCLE(A,M-L),C,D
:B=B+1:HCIRCLE(B,M+L),C,D:NEXTL:
NEXTZ:FORT=8TO63:FORL=1TO15:PALE
TTEL,T:SOUND154+T,1:NEXTL:FORD=1
5TO1 STEP-1:PALETTED,0:NEXTD:NEX
TT
```

Paul Olmstead
Toledo, OH

(For this winning one-liner contest entry, the author has been sent copies of both *The Third Rainbow Book of Adventures* and its companion *The Third Rainbow Adventures Tape.*)

Two-Liner Contest Winner . . .

This two-liner repeatedly prints a column number line index, which can be used to format printer output.

The listing:

```
1 CLS:P=PEEK(65314)AND1:IF P>0 T
HENPRINT@201,"printer offline":G
OTO1 ELSEPRINT@201,"PRINTING LIN
ES":PRINT"    HOLD <SPACE BAR> T
O STOP":FORX=1TO8:FORY=1TO9:L$=L
$+RIGHT$(STR$(Y),1):NEXTY:L$=L$+
"0":NEXTX
2 PRINT#-2,STRING$(2,13):FORX=1T
O8:PRINT#-2,STRING$(8," ");STR$(
X);:NEXTX:PRINT#-2,L$:IF PEEK(34
5)=247 THENEND ELSE2
```

Sam Mony
Kalamazoo, MI

(For this winning two-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape.*)

With Max-10: Word Processing becomes fun or your money back.
See around page 19 for info.
COLORWARE

```
005C       DIM I,J,K:INTEGER
006B       DIM DD:REAL
0072       DIM AA$:STRING[1]
007E       DIM DD$:STRING[40]
008A       DIM SATFILE$:STRING[13]
0096       SATFILE$:="satellite_dat"
00AA       OPEN #INPATH,SATFILE$:READ
00B6       PRINT #SCRN,TAB(26); "Satellite Selection Directory"
00E0       PRINT #SCRN,TAB(26); " ---------------------------"
0109       I:=0
0110       READ #INPATH,S$
011A       WHILE S$<>"DATEND" DO
012C         FOR K:=1 TO 5
013C           READ #INPATH,DD
0146         NEXT K
0151         READ #INPATH,I$
015B         I:=I+1
0166         PRINT #SCRN USING "T24,I3>,'. ',S12<,' ',S13<",I,S$,I$
0195         FOR K:=1 TO 10
01A5           READ #INPATH,DD
01AF         NEXT K
01BA         READ #INPATH,S$
01C4       ENDWHILE
01C8       REPEAT
01CA         INPUT #SCRN,"Enter number desired ",J
01EC       UNTIL J>0 AND J<=I
01FF       CLOSE #INPATH
0205       OPEN #INPATH,SATFILE$:READ
0211       READ #INPATH,S$
021B       FOR I:=1 TO J-1
022F         FOR K:=1 TO 5
023F           READ #INPATH,DD
0249         NEXT K
0254         READ #INPATH,DD$
025E         FOR K:=1 TO 10
026E           READ #INPATH,DD
0278         NEXT K
0283         READ #INPATH,S$
028D       NEXT I
0298       PRINT #SCRN,"Obtaining data for "; S$
02B8       READ #INPATH,Y3
02C2       READ #INPATH,D3
02CC       READ #INPATH,H3
02D6       READ #INPATH,M3
02E0       READ #INPATH,S3
02EA       READ #INPATH,I$
02F4       READ #INPATH,I0
02FE       READ #INPATH,O0
0308       READ #INPATH,E0
0312       READ #INPATH,W0
031C       READ #INPATH,M0
0326       READ #INPATH,N0
0330       READ #INPATH,N1
033A       READ #INPATH,K0
0344       READ #INPATH,A0
034E       READ #INPATH,F1
0358       CLOSE #INPATH
035E       PRINT #SCRN USING "'Frequency for doppler calculations: ',R8.3>,'MHz'"

             F1
039D       INPUT #SCRN,"Any change (Y/N)? ",AA$
03BC       IF AA$="Y" OR AA$="y" THEN
03D1         REPEAT
03D3           INPUT #SCRN,"Enter new frequency: ",F1
03F5         UNTIL F1>.0
0404       ENDIF
0406       END
0408
PROCEDURE meananom
0000
0001       PARAM K,M,M9,N0,N1,Q,Q0,T,T0:REAL
0028       Q:=Q0+N0*(T-T0)+N1*(T-T0)^2.
004F       K:=INT(Q+.000001)
005F       M9:=INT((Q-K+.000001)*256.)
007A       M:=(Q-K)*2.*PI
008F       END
0091
PROCEDURE elemupdt
0000
0001       PARAM A,A0,C(3,2),E0,E1,G0,I0,K0,M0,N,N0,N1,O,O0,P0,Q0,R0,T

             ,T0,W,W0:REAL
0061       DIM C0,C1,C2,E2,K2,S0,S1,S2:REAL
0084       IF N0>.1 THEN
0094         A0:=(G0/(N0*N0))^(1./3.)
00B2       ELSE
00B6         N0:=SQRT(G0/A0^3)
00C7       ENDIF
00C9       N:=N0+2.*(T-T0)*N1
00E4       A:=(G0/(N*N))^(1./3.)
0102       E2:=1-E0^2.
0115       E1:=SQRT(E2)
011E       Q0:=M0/360.+K0
0131       K2:=9.95*(R0/A0)^3.5/E2^2.
0156       S1:=SIN(I0*P0)
0163       C1:=COS(I0*P0)
```

```
 0170       O:=O0-(T-T0)*K2*C1
 0188       S0:=SIN(O*P0)
 0195       C0:=COS(O*P0)
 01A2       W:=W0+(T-T0)*K2*(2.5*C1^2.-.5)
 01CF       S2:=SIN(W*P0)
 01DC       C2:=COS(W*P0)
 01E9       C(1,1):=C2*C0-S2*S0*C1
 0206       C(1,2):=-(S2*C0)-C2*S0*C1
 0224       C(2,1):=C2*S0+S2*C0*C1
 0241       C(2,2):=-(S2*S0)+C2*C0*C1
 025F       C(3,1):=S2*S1
 0270       C(3,2):=C2*S1
 0281       END
 0283
PROCEDURE trueanom
 0000
 0001       PARAM A0,C(3,2),E0,E1,G1,G2,M,R,T,X,Y,Z:REAL
 003D       DIM C3,C7,E,G7,M1,M5,R3,S3,S7,X0,X1,Y0,Y1,Z1:REAL
 0078       E:=M+E0+SIN(M)+.5*E0^2.*SIN(2.*M)
 00A7       REPEAT
 00A9         S3:=SIN(E)
 00B2         C3:=COS(E)
 00BB         R3:=1-E0*C3
 00CB         M1:=E-E0*S3
 00DB         M5:=M1-M
 00E7         IF ABS(M5)>=.000001 THEN
 00F8           E:=E-M5/R3
 0108         ENDIF
 010A       UNTIL ABS(M5)<.000001
 011A       X0:=A0*(C3-E0)
 012A       Y0:=A0*E1*S3
 013A       R:=A0*R3
 0146       X1:=X0*C(1,1)+Y0*C(1,2)
 0162       Y1:=X0*C(2,1)+Y0*C(2,2)
 017E       Z1:=X0*C(3,1)+Y0*C(3,2)
 019A       G7:=T*G1+G2
 01AA       G7:=(G7-INT(G7))*2.*PI
 01C0       S7:=-(SIN(G7))
 01CA       C7:=COS(G7)
 01D3       X:=X1*C7-Y1*S7
 01E7       Y:=X1*S7+Y1*C7
 01FB       Z:=Z1
 0203       END
 0205
PROCEDURE geocentr
 0000
 0001       PARAM C8,C9,F,H9,L9,P0,R0,S8,S9,W9,X9,Y9,Z9:REAL
 0038       DIM L8,R9:REAL
 0043       L8:=L9*P0
 004F       S9:=SIN(L8)
 0058       C9:=COS(L8)
 0061       S8:=SIN(-(W9)*P0)
 006F       C8:=COS(W9*P0)
 007C       R9:=R0*(1-F/2.+F/2.*COS(2.*L8))+H9/1000.
 00B5       L8:=ATN((1-F)^2.*S9/C9)
 00D1       Z9:=R9*SIN(L8)
 00DE       X9:=R9*COS(L8)*C8
 00EF       Y9:=R9*COS(L8)*S8
 0100       END
 0102
PROCEDURE azelrnge
 0000
 0001       PARAM A9,C8,C9,E9,L5,P0,R,R5,R6,R8,S8,S9,T,T6,W5,X,X9,Y,Y9,

             Z,Z9:REAL
 0058       DIM B5,C5,D,S5,X5,X8,Y5,Y8,Z5,Z8:REAL
 0083       X5:=X-X9
 008F       Y5:=Y-Y9
 009B       Z5:=Z-Z9
 00A7       R5:=SQRT(X5*X5+Y5*Y5+Z5*Z5)
 00C4       IF T6<>T THEN
 00D1         R8:=(R6-R5)/(T6-T)/86400.
 00EC       ELSE
 00F0         R8:=-9.0E+09
 00FB       ENDIF
 00FD       R6:=R5
 0105       T6:=T
 010D       Z8:=X5*C8*C9+Y5*S8*C9+Z5*S9
 0131       X8:=-(X5*C8*S9)-Y5*S8*S9+Z5*C9
 0156       Y8:=Y5*C8-X5*S8
 016A       S5:=Z8/R5
 0176       C5:=SQRT(1.-S5*S5)
 018A       E9:=ATN(S5/C5)/P0
 019B       RUN QUADRANT(X8,Y8,D)
 01AF       A9:=D/P0
 01BB       RUN QUADRANT(X,Y,D)
 01CF       W5:=360.-D/P0
 01E2       B5:=Z/R
 01EE       L5:=ATN(B5/SQRT(1.-B5*B5))/P0
 020B       END
 020D
PROCEDURE quadrant
 0000
 0001       PARAM DX,DY,D:REAL
 0010       IF DX>.0 THEN
 0020         IF DY>.0 THEN
```

VIP Writer 1.1

RATED "BEST" IN SEPT '88 "RAINBOW"

VIP Writer has all the features of VIP Writer III described elsewhere in this magazine except the screen widths are 32, 51, 64 & 85. Screen colors are black, green & white, double clock speed is not supported, Spooler and menus are unavailable because of memory limitations. Even so, VIP Writer is the BEST word processor for the CoCo 1 & 2! Version 1.1 includes the configuration program and RGB Hard Disk support. Includes VIP Speller 1.1 DISK $69.95
Available through Radio Shack Express Order Cat. #90-141

Writer owners: upgrade to Writer 1.1 for $20 + $3 S/H. Send only original disk and $23 total.

VIP Speller 1.1

INCLUDES 50,000 WORD DICTIONARY

VIP Speller works with ANY ASCII file created by most popular word processors - even Telewriter 64. It automatically checks text files for words to be corrected, marked for special attention or even added to the 50,000 word Dictionary. You can even view the word in context. Words can be added to or deleted from the dictionary or you can create your own dictionary! New features of version 1.1 are FASTER and more reliable disk access and printing at 9600 baud. DISK $34.95

Speller owners: upgrade to Speller 1.1 for $10 + $3 S/H. Send original disk and $13 Total.

VIP Calc 1.1

"MORE USEABLE FEATURES" FEB. 1985 "RAINBOW"

VIP Calc has all the features of VIP Calc III described elsewhere in this magazine except the screen widths are 32, 51, 64 & 85. Screen colors are black, green and white, double clock speed and Spooler are not supported. Even so, VIP Calc is the most complete calc for the CoCo 1 & 2! Version 1.1 has faster and more reliable disk access and improved display speed. DISK $59.95

Calc owners: upgrade to Calc 1.1 for $10 + $3 S/H. Send only original disk and $13 total.

VIP Database 1.1

"ONE OF THE BEST" JUL '84 "RAINBOW"

VIP Database has all the features of VIP Database III described elsewhere in this magazine except the screen widths are 51, 64 & 85. Screen colors are black, green and white, double clock speed and Spooler are not supported. Even so, VIP Database is the most complete database for the CoCo 1 & 2! Version 1.1 has faster and more reliable disk access and single spaced reports. DISK $49.95

Database owners: upgrade to Database 1.1 for $10 + $3 S/H. Send only disk and $13 total.

VIP Disk-ZAP 1.1

RAVED ABOUT IN THE APRIL 1983 "RAINBOW"

Now you can retrieve lost data on any disk. VIP Disk-Zap is the ultimate repair utility for repair of most disk errors. VIP Disk-Zap verifies diskettes, reads and writes any sector and lets you retrieve all types of bashed text files, BASIC and ML programs. VIP Disk-Zap includes an informative 50 page tutorial manual. New features of version 1.1 are FASTER and more RELIABLE disk access and printing at up to 9600 BAUD. DISK $24.95

Disk-Zap owners: upgrade to Disk-Zap 1.1 for $10 + $3 S/H. Send original disk and $13 Total

VIP Terminal

RATED BEST IN JANUARY 1984 "RAINBOW"

For your important communications needs you've got to go beyond software that only lets you chat. You need a smart terminal so that you can send and receive programs and messages and print them! The VIP Terminal features 32, 51, 64 or 85 characters by 21 or 24 lines on the screen and has a 43K byte buffer to store information. DISK $29.95

VIP Integrated Library

Outperforms ALL OTHER integrated programs!

The VIP Integrated Library 1.2 combines all six popular VIP programs - Writer 1.1, Speller 1.1, Calc 1.1, Database 1.1, Terminal and Disk-Zap 1.1 - into one program on one disk. The program is called VIP Desktop. From the desktop you have instant access to word processing with a spelling checker always in attendance, data management with mail merge, spreadsheet financial analysis, telecommunications and disk maintenance. 64K required. DISK $149.95
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*** *** *** *** COLOR COMPUTER III SOFTWARE *** *** *** ***

CBASIC III EDITOR/COMPILER

The ULTIMATE Color Computer III BASIC COMPILER!!!

If you want to write fast efficient machine language programs and you don't want to spend the next few years trying to learn how to write them in Assembly language or with a cheap compiler, then CBASIC III is the answer!!!

CBASIC III is the only fully integrated Basic Compiler and Program Editing System available for the Color Computer 3. It will allow you to take full advantage of all the capabilities available in your CoCo-3 including 512K RAM, without having to spend years trying to learn assembly language programming. CBASIC III allows you to create, edit and convert programs from a language you are already familiar with Enhanced Disk Color Basic, into fast efficient machine language programs easily and quickly. CBASIC III supports all the enhanced hardware available in the CoCo-3, including Hi-Res Graphics, & Screen displays, Extended Memory and Interrupts (Keyboard, Timer, Serial & Clock). We even added advanced commands not available in Basic to give you a level of control only avialable to very advanced Machine Language Programmers. Plus we made it exceptionally easy to use, not like some other compilers. CBASIC III is the friendliest and easiest compiler available for the Color Computer III.

CBASIC III is a powerful tool for the Beginner as well as the Advanced Basic or Machine Language programmer. You can write programs without having to worry about the Stack, DP Register, memory allocations and so on, because CBASIC III will handle it for you automatically. For Advanced users, CBASIC III will let you control every aspect of your program, even generating machine code directly in a program easily.

CBASIC III features well over 150 Compiled Basic Commands and Functions that fully support Disk Sequential and Direct access files, Tape, Printer and Screen I/O. It supports ALL the High and Low Resolution Graphics, Sound, Play and String Operations available in Enhanced Color Basic, including Graphics H/GET, H/Put, H/Play and H/DRAW, all with 99.9% syntax compatibility. CBASIC III also supports the built in Serial I/O port with separate programmable printer & serial I/O baud rates. You can send and receive data with easy to use PRINT, INPUT, INKEY, GETCHAR and PUTCHAR commands.

CBASIC makes full use of the powerful and flexible GIMI chip in the Color Computer 3. It will fully utilize the 128K of RAM available and install 2 Ultra Fast Ramdisks if 512K is available, for program Creation, Editing and Compilation. You can easily access all 512K of memory in a Compiled program thru several extended memory commands that can access it in 32K or 8K blocks and single or double bytes.

CBASIC has its own completely integrated Basic Program Editor which allows you to load, edit or create programs for the compiler. It is a full featured editor designed specifically for writing Basic programs. It has block move and copy, program renumbering, automatic line number generation, screen editing, printer control and much more.

The documentation provided with CBASIC III is an 8 1/2 by 11 Spiral Bound book which contains approximatly 120 pages of real information. We went to great lengths to provide a manual that is not only easy to use and understand, but complete and comprehensive enough for even the most sophisticated user.

CBASIC III is the most expensive Color Basic Compiler on the market, and well worth the investment. You can buy a less expensive compiler for your CoCo-3, and then find out how difficult it is to use, or how limited its features are. Then you'll wish you had bought CBASIC III in the first place. Dollar for dollar, CBASIC III gives you more than any other compiler available. If you can find a better CoCo-3 Basic Compiler then buy it!!!

Requires 128K & Disk $149.00

DATAPACK III PLUS V1.1

SUPER SMART TERMINAL PROGRAM

AUTOPILOT & AUTO-LOG PROCESSORS
X-MODEM DIRECT DISK FILE TRANSFER
VT-100 & VT-52 TERMINAL EMULATION

- No lost data even at 2400 Baud on the COCO-3 Serial I/O port.
- 8 Display Formats, 32/40/64/80 columns at 192 or 225 Res.
- 50K Text Buffer when using the Hi-Res Text Display & Disk.
- ASCII & BINARY disk file transfer support via XMODEM.
- Directly record receive data to a disk file (Data Logging).
- VT-100 terminal emulation for VAX, UNIX and other systems.
- VT-100/52 cursor keys, position, insert/delete, PF & Alt. keys.
- Programmable Word Length, Parity, Stop Bits and baud rates.
- Complete Full and Half Duplex operation, with no garbled data.
- 9 Variable length, Programmable Macro Key buffers.
- Programmable Printer rates from 110 to 9600 baud.
- Send Files directly from the Buffer, Macro Keys or Disk.
- Display on Screen or Print the contents of the Buffer.
- Freeze Display & Review information On Line with no data loss.
- Built in Command Menu (Help) Display.
- Built in 2 Drive Ramdisk for 512K RAM support and much more.

Supports: R.S. Modem-Pak & Deluxe RS-232 Pak, even with Disk.

Requires 128K & Disk, $59.95

EDT/ASM III

128/512K DISK EDITOR ASSEMBLER

EDT/ASM III is a Disk based co-resident Text Editor & Assembler. It is designed to take advantage of the new features available in the CoCo-3 with either 128K or 512K of memory. It has 8 display formats from 32/40/64/80 columns by 24 lines in 192 or 225 Resolution, so you use the best display mode whether you are using an RGB or Composite monitor or even a TV for your display. Plus you can select any foreground or background colors or even monochrome display modes. It will even support 512K by adding an automatic 2 drive Ultra Fast Ramdisk for lightning fast assembly of program source code larger than memory. There is also a free standing ML Debug Monitor, to help you debug your assembled programs. EDT/ASM III has the most powerful, easy to use Text Editor available in any Editor/Assembler package for the Color Computer.

- Supports Local and Global string search and/or replace.
- Full Screen line editing with immediate line update.
- Easy to use Single keystroke editing commands.
- Load & Save standard ASCII formatted file formats.
- Block Move & Copy, Insert, Delete, Overtype.
- Create and Edit files larger than memory.

The Assembler portion of EDT/ASM III features include:

- Supports the full 6809 instruction set & cross assembles 6800 code.
- Supports Conditional IF/THEN/ELSE assembly.
- Supports Disk Library file (include) up to 9 levels deep.
- Supports standard Motorola assembler directives.
- Allows multiple values for FCB & FDB directives (unlike R.S. EDT/ASM)
- Allows assembly from the Editor Buffer, Disk or both.

Requires 128K & Disk $59.95

TEXTPRO IV

"The ADVANCED COCO-3 Word Processing System"

- 9 Hi-Res Displays from 58 to 212 columns by 24 lines in 225 Res.
- On Screen Display of Bold, Italic, Underline & Double Width print.
- Up to 8 Proportional Character Sets Supported with Justification.
- Up to 80 Programmable Function Keys & Loadable Function key sets.
- Fully Buffered keyboard accepts data even duiring disk access.
- Autoexecute Startup files for easy printer & system configuration.
- 8 Pre-Defined Printer function commands & 10 Programmable ones.
- Supports Library files for unlimited printing & configurations.
- Disk file record access for Mail Merge & Boiler Plate printing.
- Completely Automatic Justification, Centering, Flush left & right.
- Change indents, margins, line length, etc. anytime in the text.
- Create and Edit files larger than memory, up to a full disk.
- Easily imbed any number of printer format and control codes.
- Built in Ultra Fast 2 drive RAMDISK for 512K support.

TEXTPRO IV is the most advanced word processing system available for the COCO-3, designed for speed, flexability and extensive document processing. It is not like most of the other word processing programs available for the Color Computer. If you are looking for a simple word processor to write letters or other short documents, and never expect to use multiple fonts or proportional spacing, then most likely you'll be better off with one of the other simpler word processors. But, if you want a powerful word processor with extensive document formatting features to handle large documents, term papers, manuals, complex formatting problems and letter writing, then TEXTPRO IV is what your looking for. It works in a totally different way than most word processing programs. It uses simple 2 character abbreviations of words or phrases for commands and formatting information that you imbed directly in your text. There are over 70 different formatting commands you can use without ever leaving the text your working on. There are no time comsuming, and often frustrating menu chases, you are in total control at all times. You can see what the formatted document will look like before a single word is ever printed on your printer. Including margins, headers, footers, page numbers, page breaks, column formatting, justification, and Bold, Italic, Underline, Double Width, Superscript and Subscript characters right on the screen.

TEXTPRO IV can even support LASER PRINTERS with proportional fonts, take a good look at this AD? It was done with TEXTPRO IV on an OKIDATA LASERLINE-6 laser printer!!! All the character sets used on this AD are proportional spaced characters, all centering, justification, and text printing was performed automatically by TEXTPRO IV.

Requires 128K & Disk $89.95

HI-RES III Screen Commander

The DISPLAY you wanted but didn't get on your CoCo-3

- 54 Different Character Sizes available from 14 to 212 cpl.
- Bold, Italic, Underline, Subscript, Superscript and Plain character styles.
- Double Width, Double Height and Quad width characters.
- Scroll Protect form 1 to 23 lines on the screen.
- Mixed Text & Graphics in HSCREEN 3 mode.
- PRINT @ is available in all character sizes & styles.
- Programmable Automatic Key repeat for fast editing.
- Full Control Code Keyboard supported.
- Selectable Character & Background color.
- Uses only 4K of Extended (2nd 64K) or Basic RAM.
- Written in Ultra Fast Machine Language.

HI-RES III will improve the standard display capabilities of the Color Computer 3, even the 40 and 80 column displays have several features missing. For example, you can't use PRINT @ or have different character sizes on the same screen, even when mixing text and graphics with the HPRINT command. Hi-RES III can give you the kind of display you always dreamed about having on your CoCo-3, with a wide variety of display options that you can easily use with your Basic or ML programs.

HI-RES III is totally compatible with Enhanced Color Basic and its operation is invisible to Basic. It simply replaces the normal screen display with an extremely versatile display package. With the full control code keyboard, you can control many of HI-RES III extended functions with just a couple of simple keystrokes.

Requires 128K Tape or Disk $34.95

512K RAMDISK & MEMORY TESTER

RAMDISK is an ALL Machine Language program that will give you 2 ULTRA High Speed Ram Disks in you CoCo-3. It does not need or require the OS-9 operating system. It works with R.S. DOS V1.0 or V1.1 and it is completely compatible with Enhanced Color Disk Basic! Plus it allows your CoCo-3 to run at double speed all the time even for floppy disk access!!! It will not disappear when you press reset like some other ramdisk programs. The MEMORY tester is a fast ML program to test the 512K ram. It performs several bit tests as well as an address test so you know that your 512K of memory is working perfectly.

Requires 512K & Disk $19.95

"The SOURCE III"

DISASSEMBLER & SOURCE CODE GENERATOR

The SOURCE III will allow you to easily Disassemble Color Computer machine language programs Directly from Disk and generate beautiful, Assembler compatible Source code.

- Automatic label generation and allows specifying FCB, FDB and FCC areas.
- Disassemble programs Directly from disk, unlike other disassemblers.
- Automatically locates Begin, End and Execution address.
- Output Disassembled listing with labels to the Printer, Screen or both.
- Generates Assembler source files directly to disk or printer.
- Built in Hex/Ascii dump/display to locate FCB, FCC & FDB areas.
- 8 Selectable Display formats 32/40/64/80 columns in 192 or 225 Res.
- Selectable Foreground & Background colors & Printer Baud rates.
- Built in Disk Directory an Kill file commands.
- Menu display with single key commands for smooth, Easy operation.
- Written in Ultra Fast Machine Language.

Requires 128K & Disk $49.95

To order products by mail, send check or money order for the amount of purchase, plus $3.00 for shipping & handling to the address below.
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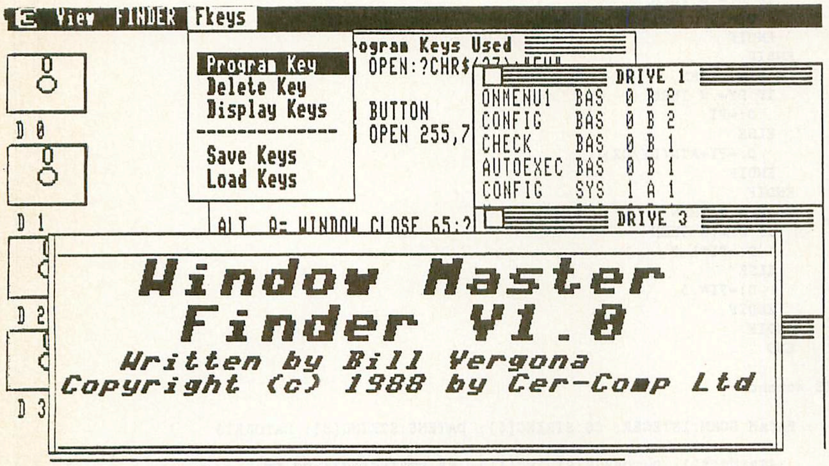
(Monday thru Saturday, 8am to 5pm PST)

CER-COMP LTD.
5566 Ricochet Avenue
Las Vegas, Nevada 89110
(702) 452-0632

"Window Master"



```
ONMENU1  BAS  0 B 2
CONFIG   BAS  0 B 2
CHECK    BAS  0 B 1
AUTOEXEC BAS  0 B 1
CONFIG   SYS  1 A 1
```

Window Master
Finder V1.0
Written by Bill Vergona
Copyright (c) 1988 by Cer-Comp Ltd

Screen Display Fonts

Window Master supports up to 54 different character sizes on the screen with 5 different character styles. You can have Bold, Italic, Underlined, Super-Script, Sub-script or Plain character styles or any combination of them in any character size. You can also change the text color and background at any time to get really colorful displays.

Fully Basic Compatible

Window Master is fully compatible with Enhanced Color Disk basic with over 50 Commands & functions added to fully support the Point & Click Window System. Window Master does not take any memory away from Basic, so you still have all the Basic Program memory available.

Hi-Resolution Displays

Window Master uses the full potential of the Color Computer 3 display by using the 225 vertical resolution display modes instead of the 192 or 200 resolution modes like most other programs. It uses either the 320/16 color mode or the 640/4 color display to give you the best display resolution possible, and can be switched to either mode at any time.

Mixed Text & Graphics

Window Master fully supports both Text & Graphics displays and even has a Graphics Pen that can be used with HLINE, HCIRCLE, HSET and more. You can change the Pen width & depth and turn it on or off with simple commands. We also added Enhanced Graphics Attributes that allow graphics statements to use And, Or, Xor and Copy modes to display graphic information. With the Graphics enhancements added by Window Master, you could write a "COCOMAX" type program in Basic! In fact we provide a small graphics demo program written in Basic.

Event Processing

Window Master adds a powerful new programming feature to Basic that enables you to do "Real Time" Programming in Basic. It's called Event Trapping, and it allows a program to detect and respond to certain "events" as they occur. You can trap Dialog activity, Time passage, Menu Selections, Keyboard activity and Mouse Activity with simple On Gosub statements, and when the specified event occurs, program control is automatically routed to the event handling routine, just like a Basic Gosub. After servicing the event, the sub-routine executes a Return statement and the program resumes execution at the statement where the event occured.

Enhanced Editing Features

Window Master adds an enhanced editor to Basic that allows you to see what you edit. It allows you to insert & delete by character or word, move left or right a word or character at a time, move to begin or end of line, toggle automatic insert on/off or just type over to replace characters. The editor can also recall the last line entered or edited with a single key stroke. You can even change the line number in line to copy it to a new location in the program.

Disk contains 128K & 512K version of program.

Window Master Features

Multiple Windows

Window Master supports multiple window displays with up to a maximum of 31 windows on the screen. Overlapping windows are supported, and any window can be made active or brought to the top of the screen. Windows can be picked up and moved anywhere on the screen with the mouse. There are 6 different Window styles to choose from and the window text, border and background color is selectable.

Pull Down Menus

Menus are completely programmable with up to 16 menus available. They can be added or deleted at any time in a program. Menu items can be enabled, disabled, checked or cleared easily under program control. Menu selection is automatically handled by Window Master & all you have to do is read a function variable to find out which menu was selected.

Buttons, Icons & Edit Fields

Each Window can have up to 128 buttons, Icons or Edit fields active, if you can fit that many. Buttons, Icons and Edit field selection is handled automatically by Window Master when the mouse is clicked on one. All you have to do is read a Dialog function to find out which Button, Icon, or Edit field was selected, its very simple.

Mouse & Keyboard Functions

Window Master automatically handles the Mouse pointer movement, display and button clicks. It will tell you the current screen coordinate, the local window coordinate, window number the mouse is in, the number of times the button was pressed, which window number it was clicked in and more. The Keyboard is completely buffered, and supports up to 80 programmable Function keys that can contain any kind of information or command sequences you can imagine. You can load and save function key sets at any time. So, you can have special sets of function keys for different tasks. The "Ctrl" key is supported so that you have a full control code keyboard available.

Window Master Applications

Window Master pushes the Color Computer 3 far beyond its normal capabilities, into the world of a "User Friendly" operating enviornment. We are already planning several new programs for use with Window Master. So you don't have to worry about having to write all your own programs. And don't forget that many existing Basic and M.L. programs will run under Window Master with little or no changes. The Possibilities for Application programs are endless: Spread Sheets, Word Processing, Communications, Education, Games, Graphic Design, Desk Top Publishing and on and on.

Hardware Requirements

Window Master requires 512K of memory, at least 1 Disk Drive, a Hi-Res Joystick Interface and a Mouse or Joystick.

Technical Assistance

If you run into difficulty trying to use some of Window Master's features, we will be happy to assist you in any way possible. You can write to us at the address below or call us between 10am and 2pm Pacific Standard Time for a more timely response. Sorry, no collect calls will be accepted.

Ordering Information

To order WINDOW MASTER by mail, send check or money order for $69.95, plus $3.00 for shipping & handling to the address below. To order by VISA, MASTERCARD or COD call us at (702)-452-0632
(Monday thru Saturday, 8am to 5pm PST)

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5566 Ricochet Avenue
Las Vegas, Nevada 89110
(702)-452-0632

Two-Liner Contest Winner . . .

The object of this two-player game is to blockade your opponent. Use the joysticks to force your opponent to run into the wall or the blue or yellow "trails."

The listing:

```
0 POKE65495,0:CLS:PRINT@12,"BLOC
KADE":PMODE1:PCLS:LINE(0,0)-(255
,191),PSET,B:C(0)=178:C(1)=96:C(
2)=76:C(3)=96:FORI=1TO1000:NEXT:
SCREEN1,0:FOROL=1TO11395:PSET(C(
0),C(1),2):PSET(C(2),C(3),3):FOR
I=0TO3:J(I)=JOYSTK(I)-32:NEXT'
(C) 1988 M. TOEPKE
1 FORI=0TO2STEP2:H=-(ABS(J(I))<A
BS(J(I+1))):C(H+I)=C(H+I)+2*SGN(
J(H+I))-2*(J(H+I)=0):NEXT:H=PPOI
NT(C(0),C(1)):I=PPOINT(C(2),C(3)
):IFH>1ANDI>1THENPRINT"BOTH LOSE
"ELSEIFH>1THENPRINT"RIGHT LOST"E
LSEIFI>1THENPRINT"LEFT LOST"ELSE
NEXT
```

Michael Toepke
Oak Harbor, WA

(For this winning two-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape.*)

Two-Liner Contest Winner . . .

Time is difficult to add and keep track of because it's in "base" 60 instead of 100. It is even more difficult to average. This one-liner provides a running total and running average of input hours, minutes and seconds.

The listing:

```
10 CLS:PRINT"TIME BY CHARLES L.
GIBSON":PRINT"TOT.-";D;"HRS.*";E
;"MIN.*";F;"SEC.":PRINT"AVE.-";L
;"HRS.*";M;"MIN.*";N;"SEC.":INPU
T"HRS..";A:D=D+A:INPUT"MIN..";B:
E=E+B:INPUT"SEC..";C:F=F+C:H=F+(
E*60)+(D*3600):J=J+1:K=H/J:L=0:M
=0:N=0
20 IFE=>60THENE=E-60:D=D+1:GOTO2
0ELSEIFF=>60THENF=F-60:E=E+1:GOT
O20ELSEIFK=>3600THENK=K-3600:L=L
+1:GOTO20ELSEIFK=>60THENK=K-60:M
=M+1:GOTO20ELSEIFM=>60THENM=M-60
:K=K+3600:GOTO20ELSEIFK<60THENN=
K:GOTO10
```

Charles Lee Gibson
Edwardsville, IL

(For this winning two-liner contest entry, the author has been sent copies of both *The Third Rainbow Book of Adventures* and its companion *The Third Rainbow Adventures Tape.*)

```
 0030           D:=ATN(DY/DX)
 003D         ENDIF
 003F         IF DY<.0 THEN
 004F           D:=2.*PI+ATN(DY/DX)
 0065         ENDIF
 0067         IF DY=.0 THEN
 0077           D:=.0
 0082         ENDIF
 0084       ENDIF
 0086       IF DX<0 THEN
 0093         IF DY=.0 THEN
 00A3           D:=PI
 00A9         ELSE
 00AD           D:=PI+ATN(DY/DX)
 00BC         ENDIF
 00BE       ENDIF
 00C0       IF DX=.0 THEN
 00D0         IF DY>.0 THEN
 00E0           D:=PI*1.5
 00ED         ELSE
 00F1           D:=PI*.5
 00FE         ENDIF
 0100       ENDIF
 0102       END
 0104
PROCEDURE scrnhdr
 0000
 0001       PARAM SCRN:INTEGER; C$:STRING[6]; DATEN$:STRING[8]; DATORB1$

             :STRING[52]; DATORB2$:STRING[11]; S$:STRING[40]; GG,LN

             :INTEGER; K:REAL
 004F       PRINT #SCRN,CHR$(12);
 005A       GG:=0
 0061       PRINT #SCRN,TAB(27); C$; " PREDICTIONS FOR "; S$
 0087       GG:=GG+1
 0092       PRINT #SCRN,TAB(8); "U.T.C.    AZ    EL   DOPPLER  RANGE HEIGHT  LAT    LONG"

             ;
 00D6       PRINT #SCRN,"    PHASE"
 00E8       PRINT #SCRN,TAB(8); "HHMM:SS   DEG   DEG    HZ      KM     KM   DEG    DEG"

             ;
 012C       PRINT #SCRN,"    (256)"
 013E       PRINT #SCRN USING DATORB1$,DATEN$,K;
 0151       PRINT #SCRN,DATORB2$
 015B       GG:=GG+3
 0166       END
 0168
PROCEDURE scrncont
 0000
 0001       PARAM SCRN:INTEGER; PV:BOOLEAN
 000E       DIM AA$:STRING[1]
 001A       IF PV THEN
 0023         END
 0025       ENDIF
 0027       PRINT #SCRN,TAB(20);
 0032       PRINT #SCRN,"Press "; CHR$($1F); CHR$($24); "ENTER"; CHR$($1F

             ); CHR$($25);
 005E       INPUT #SCRN," to continue predictions ",AA$
 0084       END
 0086
PROCEDURE prntrhdr
 0000
 0001       PARAM PRN,LN,PG:INTEGER; E8,F1,H9,K,L9,W9:REAL; C$:STRING[6

             ]; DATEN$:STRING[8]; DATORB1$:STRING[52]; DATORB2$:STRING

             [11]; S$:STRING[40]
 0061       IF PG>1 THEN
 006D         PRINT #PRN,
 0074         PRINT #PRN,
 007B         PRINT #PRN,
 0082       ENDIF
 0084       PRINT #PRN,
 008B       PRINT #PRN,
 0092       PRINT #PRN,
 0099       PRINT #PRN,TAB(16); C$; " PREDICTIONS FOR "; S$; ", BEACON: "

             ; F1; "MHZ"
 00D6       PRINT #PRN,TAB(8); C$; TAB(15); "LAT= "; L9; TAB(27); "W. LONG= "

             ; W9;
 0109       PRINT #PRN,TAB(44); "ALT= "; H9; "METERS"; TAB(62); "PAGE: "

             ; PG
 0139       PRINT #PRN,TAB(25); "MINIMUM ELEVATION = "; E8; " DEGREES"
 0169       PRINT #PRN,TAB(8); "----------------------------------------"

             ;
 019F       PRINT #PRN,"-----------------------"
 01BF       PRINT #PRN,TAB(8); "U.T.C.    AZ    EL   DOPPLER  RANGE HEIGHT  LAT    LONG"

             ;
 0203       PRINT #PRN,"    PHASE"
 0215        PRINT #PRN,TAB(8); "HHMM:SS    DEG    DEG    HZ        KM      KM   DEG     DEG"

               ;
 0259        PRINT #PRN,"    (256)"
 026B        PRINT #PRN,TAB(8); "---------------------------------------"

               ;
 02A1        PRINT #PRN,"----------------------"
 02C1        PRINT #PRN USING DATORB1$,DATEN$,K;
 02D4        PRINT #PRN,DATORB2$
 02DE        LN:=LN+8
 02E9        END
 02EB
PROCEDURE strngnum
 0000
 0001        PARAM STR:STRING[2]; NUM:REAL
 0013        STR:=CHR$(48+FIX(INT(NUM/10.)))+CHR$(48+FIX(NUM-10.*INT(NUM

              /10.)))
 0044        END
 0046
PROCEDURE sidereal
 0000
 0001        PARAM YEAR,G2:REAL
 000C        DIM DAYS78:REAL
 0013        DAYS78:=INT((YEAR-77.)*365.25)-366.
 0031        IF YEAR<=77 THEN
 003E          DAYS78:=DAYS78+36525.
 004D        ENDIF
 004F        G2:=DAYS78*2.73790931E-03+DAYS78*DAYS78*8.05975E-16+.278586056
 0074        G2:=G2-INT(G2)
 0081        END
```

Listing 2: echo.source

```
 ****************************************************
*
* ECHO  -  COPYRIGHT (c) 1988 by S.B.GOLDBERG
*
* Echo text to standard output path with some
* UNIX like enhancements.
*
* Use: Echo [text]
*       \c = terminate without new line
*       \f = clear screen (form-feed)
*       \n = go to new line
*       \\ = print backslash
*       \### = print decimal ### ASCII character
*
         ifpl
         use    /d0/defs/os9defs
         endc
*
         mod    len,name,prgrm+objct,reent+1,entry,dsiz
*
hicount  rmb    1   msb character count
locount  rmb    1   lsb character count
         rmb    200   stack
         rmb    200   parameter
dsiz     equ    .
*
name     fcs    /Echo/
         fcb    1   edition number
         fcc    /(c)1988 S.B.Goldberg/
******************************
* CONVERT AND DISPLAY
******************************
entry    clr    hicount   zero character count
         clr    locount
         tfr    x,y   start of text
         pshs   x   save parameter pointer
loop     ldb    ,x+   get text character
         cmpb   #'\   backslash?
         bne    save   no, save character
         ldb    ,x+   get next character
         cmpb   #'\   backslash?
         beq    save   yes, save it
         orb    #32   make lower case
         cmpb   #'c   print without new line?
         beq    print   yes, print line
         cmpb   #'f   form feed (clear screen)?
         bne    newln   no, check for new line
         ldb    #$0c   yes, clear screen character
         bra    save   save it
newln    cmpb   #'n   new line?
         bne    ascii   no, test for ascii number
         ldb    #$0a   yes, line feed
         bra    save   save it
ascii    bsr    num   decimal number to binary
         tstb    zero?
         beq    loop   yes, continue looking
save     stb    ,y+   save output character
         inc    locount   count it
         cmpb   #$0d   end of parameter?
         bne    loop   no, get next character
print    ldy    hicount   output length
         puls   x   output address
         lda    #1   standard output path
         os9    i$writln   print it
         bcs    out   exit with error
         clrb    clear error flag
out      os9    f$exit   quit
******************************
* DECIMAL NUMBER TO BINARY
******************************
num      leax   -1,x   reset pointer
         clrb    zero value
         bsr    bin   first digit
         bsr    bin   next 2 digits
bin      lda    ,x   get digit
         suba   #'0   make binary
         cmpa   #9   valid digit?
         bhi    back   no, return
         pshs   a   yes, save it
         lda    #10   multiply old total
         mul    by ten
         addb   ,s+   add current digit
         leax   1,x   bump pointer
back     rts    return
*
         emod
len      equ    *
         end
```

Listing 3: Make Echo

```
PROCEDURE MakeEcho
 0000        (* Generates the module "Echo" in the CMDS directory *)
 0037        DIM path,byt:BYTE
 0042        DIM count:INTEGER
 0049        (* If echo already exists in your CMDS directory *)
 007C        (* include the following line *)
 009C        (* SHELL "rename /dd/cmds/echo echo.old" *)
 00C7        CREATE #path,"/dd/cmds/echo":WRITE
 00DF        FOR count=1 TO 137
 00EF          READ byt
 00F4          PUT #path,byt
 00FE        NEXT count
 0109        CLOSE #path
 010F        SHELL "attr /dd/cmds/echo e pe"
 012A        END
 012C        DATA 135,205,0,137,0,13,17,129,161,0,38,1,146,69,99
 015D        DATA 104,239,1,40,99,41,49,57,56,56,32,83,46,66,46
 018E        DATA 71,111,108,100,98,101,114,103,15,0,15,1,31,18,52
 01BF        DATA 16,230,128,193,92,38,33,230,128,193,92,39,27,202,32
 01F0        DATA 193,99,39,29,193,102,38,4,198,12,32,13,193,110,38
 0221        DATA 4,198,10,32,5,141,27,93,39,217,231,160,12,1,193
 0252        DATA 13,38,209,16,158,0,53,16,134,1,16,63,140,37,1
 0283        DATA 95,16,63,6,48,31,95,141,2,141,0,166,132,128,48
 02B4        DATA 129,9,34,9,52,2,134,10,61,235,224,48,1,57,30
 02E5        DATA 168,89
```

Accessible Applications

The importance of standard formats in file and directory use

What's the Difference?

By Richard A. White
Rainbow Contributing Editor

I received a call from Bill Guthke of Greenville, South Carolina, and his problem was pertinent to this month's topic. Although fairly new to the CoCo and to OS-9, Bill did run a Model I and works as an industrial-controls specialist. Further, he had read the manuals and one of Dale Puckett's books. Unfortunately, he had little opportunity to practice what he had read, so OS-9's use of directories hadn't sunk in. Basically, Bill was unable to load `Config` or `BASIC09`. Let's work through the basics of directory use, so we can understand the basics of Bill's problem.

Let's start with the OS-9 distribution disk's directories. A directory is a table of filenames and the data pertinent to each. Some of those filenames can be the names of other directories (sub-directories) under the one we are reading. The first directory table on a disk is for the root directory, and it begins in Sector 3 of the disk. Since sector numbering begins with zero, this is the fourth sector. All OS-9 files, including directories, have file-header sectors, and the root directory's file header is in Sector 2.

The sector number identifying the beginning of the file or sub-directory offers information for each listing in a directory table. If we start with a freshly-formatted disk and make a new `CMDS` directory on it, we use the command `MakDir` in the following manner:

```
OS9:makdir /d0/CMDS
```

The word *CMDS* is displayed as the first file listing in Sector 3 and starts at Byte 64. After the four bytes representing the letters C, M, D and S, there are zeros until Byte 95, which is $0A (10 decimal). This means that the `CMDS` directory's header starts at Sector $0A. (Actually, OS-9 uses three bytes for sector location, but in this example the first two bytes are zero, so I won't write them out.)

Note that when you format a disk, the format process allocates sectors for the root directory. If you type `free /d0` to determine the space available for a 35-track, single-sided disk, the computer identifies that disk capacity is 640 sectors and that 630 are free. The format process allocates sectors $01 to $09 for the root directory.

On the OS-9 system disk, the first file in the root directory (Sector 3) is `OS9boot`. Byte 95 now refers to the starting location for `OS9boot` and is also $0A, which is the first free sector after the sectors allocated for the root directory. The next root directory entry, `CMDS`, starts at Byte 96 of Sector 3. Its starting sector is shown at Byte 127 as $75. All the sectors between $0A and $75 have been used by `OS9boot`. Note: These are the locations used on the Level II system and `Config` distribution disks. The same pattern holds for the Level I versions, but the `CMDS` directory location on this system disk is different because the length of Level I's `OS9boot` is different.

Now let's consider what happens when you boot using the system disk. OS-9 assigns its current execution and data directories in memory. A current execution directory is the drive and disk directory in which OS-9 will look for an executable (program) module when a module name has been entered at the OS-9 prompt. A current data directory is the drive and disk directory in which OS-9 looks for a data file if given a filename and no other path data.

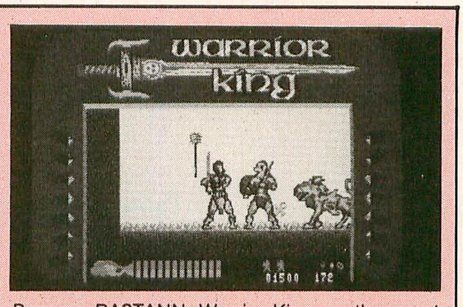
These files will be on `/d0` or on your hard drive (`/h0`). The data directory will be the root directory whose header is on Sector 2, so an $00 00 02 location will be stored in memory. Whenever OS-9 needs to find a data file, it will determine the drive number for the current data file and then find the sector where the directory itself starts. It does the same thing when it is looking for an executable module, which it expects to find in the current `CMDS` directory.

Now we have enough information to consider the trap Bill has fallen into. First, he booted using a backup of his distribution disk. OS-9 carefully recorded the sectors where the root and `CMDS` directories started, so it could use them as its current data and execution directories. He then replaced his system disk with his disk containing `Config`

Richard White lives in Fairfield, Ohio, has a long background with microcomputers and specializes in BASIC *programming. With Don Dollberg, he is the co-author of the* TIMS *database management program.*

SUNDOG SYSTEMS

Warrior King



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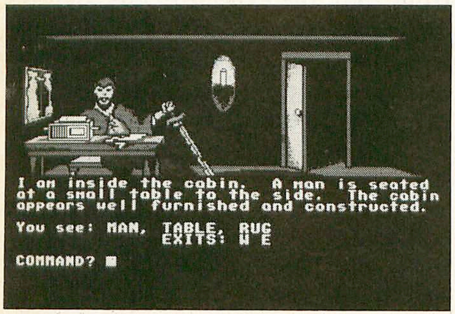

```
I am inside the cabin.  A man is seated
at a small table to the side.  The cabin
appears well furnished and constructed.

You see: MAN, TABLE, RUG
          EXITS: W E

COMMAND? ■
```

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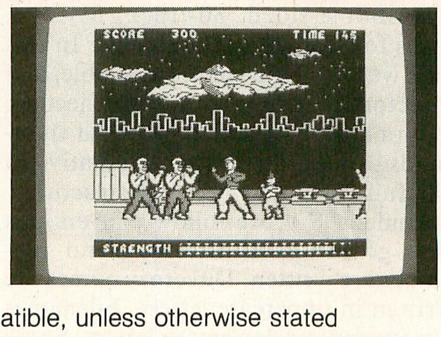

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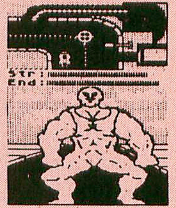

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and typed `Config`. OS-9 went through the following reasoning process: It first looked at its in-memory module table and found no `Config`. It next looked up the starting sector of the current execution directory and read that sector. Because the `CMDS` directory on the `Config` disk was at a different location than on a system disk, OS-9 looked in what was now the wrong sector. It did not read what it expected to read and stopped trying to find a `CMDS` directory on the disk.

At this point, OS-9 looked for a data directory. Since the root directory started on the same sector on both disks, it found a directory, but there was no `Config` listed in that directory. OS-9 had no choice but to send the "Path Name Not Found" message.

I asked Bill to boot up his machine, put in his `Config` disk and enter the following:

```
OS9:chx /d0/cmds
OS9:config
```

He reported disk action, and then `Config` came up for him for the first time.

I have spent a lot of time explaining why you must use the command `chx` and/or `chd` when you change disks. Not doing so is one of the more frequent errors a new or occasional user makes, and it is difficult for inexperienced users to figure out their errors by themselves. Count on making this mistake in the future, but remember how to solve the problem it causes.

I had problems because the manual and distribution disk for OS-9 Level I did not agree in procedure. The manual instructs users to type `basic09` to start the program. Anyone who did so got the infamous 216 Error. Ultimately, I (and many others) discovered that the distribution disk had no commands directory, and all files are saved in the root directory. The root directory worked for a data directory, but OS-9 would not load an executable module from a data directory. Users could load BASIC09 by typing the full path name: `/d0/basic09`. The best solution was to copy BASIC09 to a `CMDS` directory that could be used as a current execution directory. After all, you need a `CMDS` directory to store your packed modules.

Also, I expect others to set up OS-9 directories and files the same way I do when I "follow the book." Deviations waste my time and cause confusion when I discuss problems and possible solutions. There is a *wrong* way to correct the Level I distribution disk that works: Change your current execution directory to whatever directory the program module you want is in — regardless of the directory's name. It could be a root directory.

Since this works, you may wonder why I consider it wrong. It's wrong because it is not organized, nor would this procedure be expected. This may not seem important to beginners, whose only programs are those that come on their OS-9 disks. However, it becomes vital as you collect more and more software. A hard disk can look like a library after a tornado if a careful directory discipline is not maintained.

The primary purpose of directories is to organize files so they can be found easily. They are just like file folders and file drawers. The number of directories you have on a disk is dependent on how you want to organize your files. If you are using 35-track, single-sided drives, you may not have any directories on a data disk. The disk itself is the directory. However, a double-sided, 40-track drive provides over twice as many file sectors for storage, and having a number of directories on these larger-capacity disks makes sense. Some of us use double-sided, 80-track, 3½-inch disks for storage and archiving. In this case we have 2880 sectors available, and directories are nearly always needed. With hard disks, which can hold thousands of files, there is no alternative to carefully planning directory structure.

Under OS-9, we follow conventions that govern how directory and filenames are written. Directory names are written in uppercase letters. Filenames always contain lowercase letters. Some may have a number of uppercase letters, like `CC3Disk`, but there are always some lowercase letters as well. This way, you can scan a directory listing and identify directories and files.

If you accidentally use all uppercase letters for filenames or put lowercase letters in a directory name, use `Rename` to correct it — whether it is a filename or a directory name. OS-9 doesn't care if you use upper- or lowercase. So when you are changing a directory or calling a module, you can use either. The upper- and lowercase conventions are meant to help you read directory listings, not to help OS-9.

Let me give you some examples. Table 1 shows a portion of the root directory on my hard drive:

```
CALC          CMDS          COM           DOCS
DS            FORTH         GAMES         HPUB
MODULES       RAINBOW       RFEST1088     SCULPTOR
SPELL         SYS           TEMP          TESTING
UTIL          dynacalc.trm  startup
```

Table 1: Directory of . . 15:27:44

Since my system boots in part from the hard drive (after `OS9Boot` is loaded from `/d0`), the expected `CMDS` and `SYS` directories are present. The `StartUp` file is in the root directory where OS-9 expects it. The only other file present in my root directory is `dynacalc.trm`, which is used by *DynaCalc* to initialize itself.

The `CMDS` directory contains all the commands and programs that I routinely use (currently, 92 files). These files have nothing in their names to indicate that they are executable, but I know they are since I only put executable modules in a `CMDS` directory.

Some programs, like *Home Publisher* and *Sculptor*, use files that are designed to go in a `CMDS` directory but are not executable files. On the hard drive, I make a directory for each application and put these files in a `CMDS` sub-directory under the application directory. (Those using only floppies have one or more application disks with a `CMDS` directory on each.)

All of us collect software we very seldom use. Unless you have limited space, the only reason to keep these modules in a separate directory is to make them easier to find for use or update. I keep two directories, `UTIL` and `MODULES`, with a `CMDS` sub-directory under each for unused modules.

Those of you who use only floppies work under a more severe capacity limit and need to move infrequently used modules to other disks for storage.

Again, include a `CMDS` directory on each disk and put your modules there, so you know they are programs and not data files. I sometimes make a backup of my current boot disk and then delete `OS9Boot` and everything in the `CMDS` directory. Then I copy a selection of program modules onto this disk. This disk can replace the boot disk without changing directories.

Finally, keep your directory names short. This saves typing and makes directories easier to use. If they are easy to use, you are more likely to use them. As far as OS-9 is concerned, all disk files are the same. They consist of a file header and sectors of bytes. The first byte in the file-header sector is the attribute that tells OS-9 whether it is a directory or a file — and if it is a file, whether it can be read, written to or executed. This is all OS-9 wants to know about the file contents. The remainder of the file header contains data OS-9 needs to read or write to the file. Included in this information is the length of the file because OS-9 files do not include an end-of-file marker. The file itself includes only information written by the application that saved it. OS-9 could have sent it anywhere — to a printer, through a serial port or to the display. This is what is meant by the term "Unified Input/Output System." The file data is not specific in any way to the device to which it is sent.

File content is specific to the application. A *DynaCalc* spreadsheet can be sent to a printer or to a display, but it won't make any sense to you. It needs *DynaCalc* to translate it to a readable form. On the other hand, you can redirect a program's screen output to the printer, where it is completely readable. Software hackers delight in writing file-handling utilities. You can get utilities to count files, lines, words and letters, sort files, and filter and search files. One of the more useful utilities is one that compresses a file, generally for archive-storage purposes. These utilities take advantage of each series of the same character that are found in many files. In other words, if you indent a paragraph in a letter, you might insert five spaces. A compression program finds this series of characters and replaces it with two or three bytes identifying the character and its number in the series.

A good archive program also stores multiple files in one sequence, which wastes little space. If a file uses only one byte of its last sector, OS-9 allocates that whole sector to the file. An archive program is set up to start the next archived file in the byte that follows the end of the preceding file. Savings of 10 to 60 percent are possible with text files. These columns normally can be compressed to save 40 percent of their original length.

`AR` and `PAK` are the two widely used OS-9 archiving programs. Both are available for downloading on the Delphi OS-9 SIG Database. They are also available from many other BBSs. I suggest you get both since you will find downloads archived both ways.

OS-9's use of directories makes file location and sorting much easier. This ease gives OS-9 users more freedom to use a variety of applications; however, it can also make learning to use the system effectively a little more difficult. If we standardize our methods of directory use and modification, we can make this system easier to use and more enjoyable.

See you next month.

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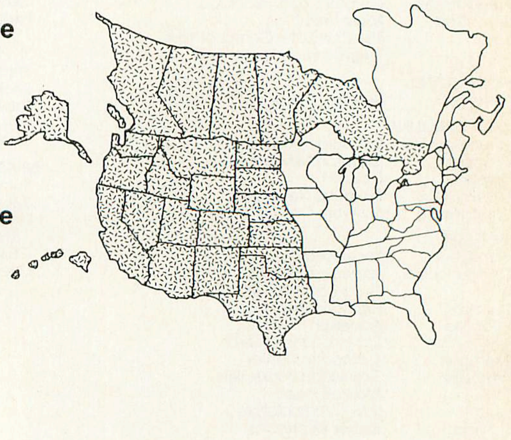

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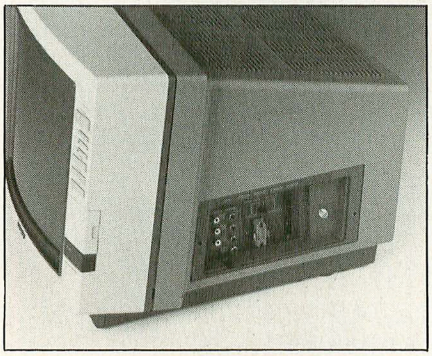

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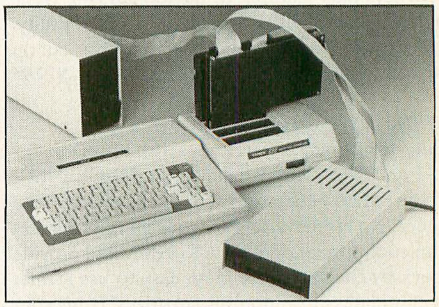

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As the checkered flag drops your pulse rises in this lively arcade game. The road twists to the horizon on the 3-D panorama that sets the stage for exciting racing. Vie for time as you glide through the curves at incredible speeds. Step through the gears to stay ahead of the pack, but be quick! Some will stop at nothing to see the end of the race, or the end of you! Four challenging raceways, complete with obstacles and colorful 3-D scenery test your skills in this Pole Position™ type game.

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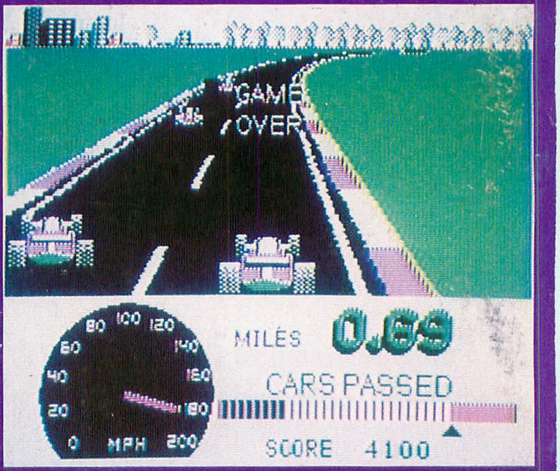
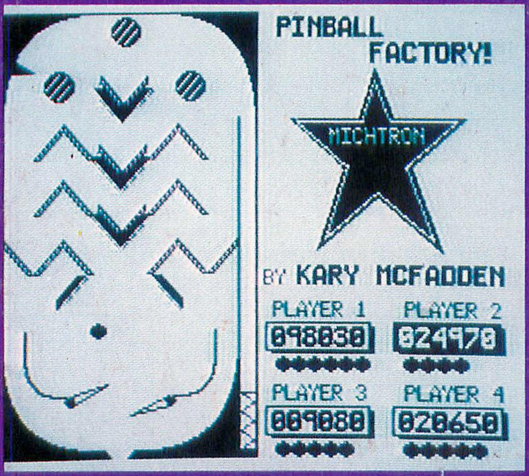




Pinball Factory

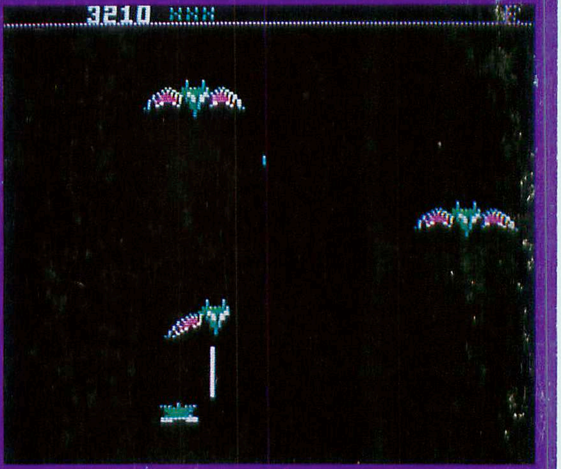
Video games come full circle in this tribute to the original arcade game, *Pinball*. Classic pinball springs to life as never before, with fresh new angles that only a computer can offer. Crisp graphics, sound, and fast smooth action give this machine-language arcade game a realistic, responsive feel you'll hardly believe. There are even "tilt" buttons that let you "bump" the machine. In addition to playing a great game of pinball, you can enjoy hours of creative pleasure as you design, build, edit, and play your own screens.

64K Color Computer required...$34.95

Demon Seed

The first waves of flying, diving, bloodthirsty bats are arriving. Move, fire, and move again. It's a never ending battle. If you are lucky enough to defeat the bats, be ready for a much greater challenge, The *Evil Demons* themselves. Destroy a wing and another takes its place. Only a direct hit can save you now. It will take great skill to triumph. If you do, then you better be ready for the *End*. The Demon Flag Ship descends to destroy your remaining ships. Your only hope is to penetrate the hull, break through the shield, and destroy the dreaded Gargoyle.

32K Color Computer required...$19.95



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